

Strait of Georgia Juvenile Herring Survey, September 2005 and October 2006

M. Thompson and J. Schweigert

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, British Columbia
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STRAIT OF GEORGIA JUVENILE HERRING SURVEY,
SEPTEMBER 2005 AND OCTOBER 2006

by

M. Thompson and J. Schweigert

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
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V9T 6N7

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ABSTRACT

Thompson, M., and Schweigert, J. 2007. Strait of Georgia juvenile herring survey, September 2005 and October 2006. Can. Manuscr. Rep. Fish. Aquat. Sci. 2825: v + 56 p.

Fall juvenile herring surveys of the Strait of Georgia took place in 2005 and 2006. Forty-six to forty-eight stations were sampled throughout the Strait of Georgia following the ten core transects that have been sampled since 1990. The survey area extends from Trincomali Channel in the south to Smelt Bay in the north. Both surveys were run from mid-September into early October. Plankton tows were performed to determine food organism abundance in the study area. CTD casts were made *only* during the 2006 survey to determine temperature, salinity and dissolved oxygen.

RESUME

Thompson, M., and Schweigert, J. 2007. Strait of Georgia juvenile herring survey, September 2005 and October 2006. Can. Manuscr. Rep. Fish. Aquat. Sci. 2825: v + 56 p.

Des relevés d'automne de harengs juvéniles ont été effectués dans le détroit de Georgia en 2005 et 2006. Entre 46 et 48 stations ont été échantillonnées dans l'ensemble du détroit de Georgia le long des dix transects centraux qui font l'objet d'échantillonnages depuis 1990. La zone de relevé s'étend du chenal Trincomali à la baie Smelt. Les deux relevés ont été menés de la mi-septembre au début d'octobre. Des traits de filet à plancton ont été réalisés en vue de déterminer l'abondance des organismes-proies dans la zone d'étude. Des sondes CTD ont été utilisées *seulement* lors du relevé de 2006 et ont servi à mesurer la température, la salinité et la teneur en oxygène dissous.



INTRODUCTION

Pacific herring (*Clupea pallasi*) are an important commercial and vital forage species for many marine mammals, birds and other fish in British Columbia's coastal waters. Herring spawn principally on marine vegetation in the upper subtidal and intertidal zones between February and June, with peak spawning occurring between March and April (Humphreys and Hourston 1978). Larvae hatch in two to three weeks, and disperse with surface currents, metamorphosing into juvenile herring at a length of ~25mm (Hourston and Haegele 1980). Herring are considered juvenile until they are three years of age and have joined the sexually mature spawning population (Hay and McCarter 1999). During daylight hours, juvenile herring congregate in schools, occasionally forming mixed aggregates with other pelagic species, close to shore near the bottom (Haegele 1997). At dusk, these fish migrate into surface waters to feed on plankton. During this time they are vulnerable to purse seine gear.

Purse seine surveys to determine the distribution and abundance of juvenile herring in the Strait of Georgia (Figure 1) have been conducted annually since 1990, except for 1995. The main objective of the survey was to estimate the density and relative abundance of the juvenile herring population as a potential indicator of recruitment before they have joined the spawning stock. In addition to recruitment prediction, the surveys have contributed to a better understanding of the distribution, abundance, and ecological role of herring in the Strait of Georgia.

METHODS

The fall Strait of Georgia juvenile herring survey for 2005 (Figure 2) and 2006 (Figure 3) monitored the ten core transects (1 – 6, 8 – 11); which are made up of 48 sampling stations and have been sampled consecutively since 1990 (except 1995). These ten core transects are used in juvenile herring recruitment prediction (Hay et. al. 2003). The sampling sites originally were chosen based on known historical herring spawning sites, and represent both nearshore and open water habitats (Haegele et. al. 2005). In 2005, sampling was conducted from September 19 to October 5 (Table 1). A total of 46 of the 48 core stations were sampled. Two samples were dropped due to the onset of inclement weather and a total of three days were lost due to bad weather during the survey period. In 2006, sampling was conducted from September 18 to October 3 (Table 2). All 48 stations were sampled successfully with no lost days due to weather.

Fish Sampling

The 12m, aluminium-hulled Fisheries Research Vessel *Walker Rock* was used for all fishing events. A 183m long and 27m deep purse seine net of knotless web, resulting in an area fished of ~2665m², was used for all fishing events. The body of the net had 46m of 22.2mm mesh at the tow end followed by 91m of 19.0mm mesh, and the bunt end was

46m of 9.5mm mesh. The net fished to a depth of 10m, and was able to retain fish greater than 20mm in length. All sets were made after dusk when herring are feeding near the surface. All sets were made "blind" at the predetermined sampling stations. Up to five sets were completed per night, depending on location. For most sets, it was possible to land the entire catch for biological sampling. On occasion, it was not practical to land a large set in its entirety, so sub-sampling was necessary. When sub-sampling was required, a 40kg tote was filled with randomly selected fish and retained for biological sampling. Several dipnet samples from various parts of the net (catch) would be used to make up the random sub-sample. The remainder of the set was released over the corkline, its size estimated as the number of totes released. The number of herring caught in each set was determined by dividing the total catch weight by the mean weight of sub-sampled herring. The number of other species caught was determined in the same manner (Tables 3 and 4). All fish retained for sampling were bagged and preserved in a 3.7% seawater formalin solution, with the exception of large predator species (e.g. adult salmon and flatfish). These fish were individually measured in the field. All retained fish were later sampled in the laboratory at the Pacific Biological Station within two weeks of capture. From each set, 200 or more herring and all other fish species caught were identified, weighed and measured. If the set contained less than 200 herring, then all herring were weighed and measured. Consistent with standard practices, herring were measured to standard length, salmon to fork length and groundfish to total length; all to the nearest millimeter. All other fish species were measured to standard length.

Plankton Sampling

Twenty stepped oblique plankton tows were performed during both surveys (Figures 4 and 5). The tows always were completed after dusk and immediately before the fishing events. A nearshore and offshore tow location were sampled for all transects. Dual 19cm diameter bongo nets with 350 μ m mesh were used for sampling, resulting in 'left' and 'right' bongo plankton samples (only left samples were processed). The bongos were lowered to 20m (10m in shallow areas) and raised by an electric winch at a rate of 1m every 15sec (or 1m every 30sec for shallow areas). A General Oceanics® 2030R model flowmeter was attached to the left bongo to determine the volume of seawater filtered. Volume filtered was calculated using the following equation (McCarter and Hay 2002):

$$V = (A \cdot F \cdot K) / 999,999$$

Where:

V = volume of water filtered through the plankton net (m^3)

A = area of net opening ($0.02835m^2$)

F = number of revolutions recorded by the flow meter (m)

K = standard speed rotor constant for 7cm rotor (26,873)

Upon retrieval, the bongo nets were washed with a high pressure deck hose, and the samples preserved in 3.7% seawater formalin.

In the laboratory, a volumetric splitter was used to reduce the sample size to a point where organisms could be conveniently counted and identified in a counting tray using a stereo microscope under 30X magnification. Sample splitting continued until a target size of roughly 300 organisms was reached (Thompson et al. 2003).

Plankters were identified to the lowest taxonomic level. Copepods were identified to species. Densities for all plankters were determined and expressed as plankters · m⁻³.

CTD Sampling

To characterize oceanographic conditions in the surveyed area, a total of 20 CTD (conductivity – temperature – density) casts were made using a RBR XR-620 (Figure 5) for *only* the 2006 survey. A CTD cast was performed at each plankton tow location following the nearshore/offshore sampling protocol. The CTD unit was weighted and lowered over the side of the vessel, at a rate of 1m/sec, to within two meters of the bottom. Data was downloaded to a laptop computer from the CTD unit after each evenings sampling.

RESULTS

Herring 2005

Forty-six stations were sampled from Transects 1 – 6, 8 – 11. A total of 4048 herring were weighed and measured resulting in a length frequency distribution that was distinctly bimodal (Figure 6). Three length designations for the juvenile herring age-classes were produced:

Age-0+ = herring less than or equal to 100mm standard length

Age-1+ = herring between 101mm and 126mm standard length

Age-2+ and older = herring greater than or equal to 127mm standard length

Age-0+ herring occurred in 26.1% of the stations (Table 5). Only twelve of the forty-six stations contained age-0+ herring and none caught in transects 1, 5 and 9. The mean length and weight for age-0+ herring was 96mm and 12.05g respectively. A total of 36 age-0+ were caught for a total weight of 0.45kg (Table 6). This has been the lowest catch rate for this age-class for the entire fifteen year history of the survey.

Age-1+ herring occurred in 78.3% of the stations (Table 5). The mean length and weight for age-1+ herring was 112mm and 18.51g respectively. A total of 2986 age-1+ herring were caught for a total weight of 60.03kg (Table 6).

Age-2+ herring occurred in 65.2% of the stations (Table 5). The mean length and weight for age-2+ herring was 144mm and 42.74g respectively. A total of 23116 age-2+ herring were caught for a total weight of 998.55kg (Table 6).

Length frequency histograms by transect location for all sampled herring are shown in Figure 8. Most transects were dominated by a single age-class, mainly being age-1+ or age-2+ herring. The majority of these fish being caught in Henry Bay (Transect 4), French Creek (Transect 5) and Atrevida Reef (Transect 9). A length-weight relationship for all sampled herring from the survey showed a positive correlation coefficient (r) of 0.958 (Figure 9).

Herring 2006

Forty-eight stations were sampled from Transects 1 – 6, 8 – 11. A total of 6914 herring were weighed and measured resulting in a length frequency distribution (Figure 7) that distinctly identified three length designations for the juvenile herring age-classes:

Age-0+ = herring less than or equal to 108mm standard length

Age-1+ = herring between 109mm and 128mm standard length

Age-2+ and older = herring greater than or equal to 129mm standard length

Age-0+ herring occurred in 95.8% of the stations (Table 5). Only two stations resulted in catching no age-0+ herring. The mean length and weight for age-0+ herring was 75mm and 5.3g respectively. A total of 150991 age-0+ were caught for a total weight of 752.0kg (Table 7).

Age-1+ herring occurred in 6.3% of the stations (Table 5). The mean length and weight for age-1+ herring was 119mm and 22.3g respectively. A total of 31 age-1+ herring were caught for a total weight of 0.7kg (Table 7). This is a continuation of the weak age-0+ age class that was observed in 2005.

Age-2+ herring occurred in 8.3% of the stations (Table 5). The mean length and weight for age-2+ herring was 164mm and 63.9g respectively. A total of 441 age-2+ herring were caught for a total weight of 27.5kg (Table 7). The majority of age-2+ herring were caught in French Creek (Transect 5, station 2). This station was frozen and later sampled for DNA and scales for aging.

Length frequency histograms by transect location for all sampled herring are shown in Figure 8. The majority of transects were dominated by a single age-class, mainly being age-0+ herring. There seemed an even distribution of age-0+ herring throughout the survey area, except for French Creek (Transect 5) and Smelt Bay (Transect 8). A length-weight relationship for all sampled herring from the survey showed a positive correlation coefficient (r) of 0.9763 (Figure 10).

Plankton 2005

There were 15 categories of organisms identified in 20 plankton samples (Tables 8 and 9). Four plankton samples were removed from the data analysis as a result of a malfunctioning flow meter (Smelt Bay, Station 1 in Bowser and Clarke Rock). An average of 12.5628m³ of water was filtered per plankton tow. Copepods occurred in all

samples. Unidentifiable juvenile calanoid copepods, *Corycaeus anglicus*, and *Paracalanus parvus* were the only organisms to occur in all samples. Amphipods, barnacle larvae, *Corycaeus anglicus*, gastropods, larvaceans (*Oikopleura sp.*, and *Fritillaria sp.*), *Oithona similes*, *Pseudocalanus minutus*, *Paracalanus parvus*, shrimp larvae and unidentifiable juvenile calanoid copepods (mainly *Calanus sp.*) made up >75% of the samples.

Plankton 2006

There were 18 categories of organisms identified in 20 plankton samples (Tables 8 and 9). An average of 12.4705m³ of water was filtered per plankton tow. Copepods occurred in all samples. Cladocerans and barnacle larvae were the only organisms to occur in all samples. Amphipods, barnacle larvae, *Corycaeus anglicus*, cladocerans, medusae (*Aequorea victoria*), crab zoea, gastropods, larvaceans (*Oikopleura sp.*, and *Fritillaria sp.*), *Paracalanus parvus*, shrimp larvae, siphonophores, and unidentifiable juvenile calanoid copepods (mainly *Calanus sp.*) made up >75% of the samples.

CTD

Two CTD casts were performed at each transect at a nearshore and offshore sampling location for *only* the 2006 survey. The CTD provided a range of data for temperature (°C), salinity (ppt), dissolved oxygen (%) and depth (m) (Figure 11).

CONCLUSION

2005

Forty-six stations were sampled resulting in 20 different fish species recorded from purse seine sets. A total of 4048 herring were measured and weighed creating a distinct bimodal histogram representing three juvenile herring age groups. Twenty plankton tows were performed resulting in unidentifiable juvenile calanoid copepods, *Corycaeus anglicus*, and *Paracalanus parvus* being the predominant organisms by percent occurrence and larvaceans (*Oikopleura sp.*, and *Fritillaria sp.*) is the predominant organism by quantity.

2006

Forty-eight stations were sampled resulting in 20 different fish species recorded from purse seine sets. A total of 6914 herring were measured and weighed creating a distinct histogram representing three juvenile herring age groups. Twenty plankton tows were performed resulting in cladocerans and barnacle larvae being the predominant organisms by percent occurrence and larvaceans (*Oikopleura sp.*, and *Fritillaria sp.*) being the

predominant organism by quantity. CTD casts were also performed providing temperature, salinity and dissolved oxygen information.

ACKNOWLEDGMENTS

These two surveys were funded by the Herring Conservation and Research Society (HCRS) and the Department of Fisheries and Oceans. Both surveys could not have been possible without the hard work and good cheer of skipper Doug Henderson and pelagics biologist Charles Fort. Plankton samples were processed by Zotec services.

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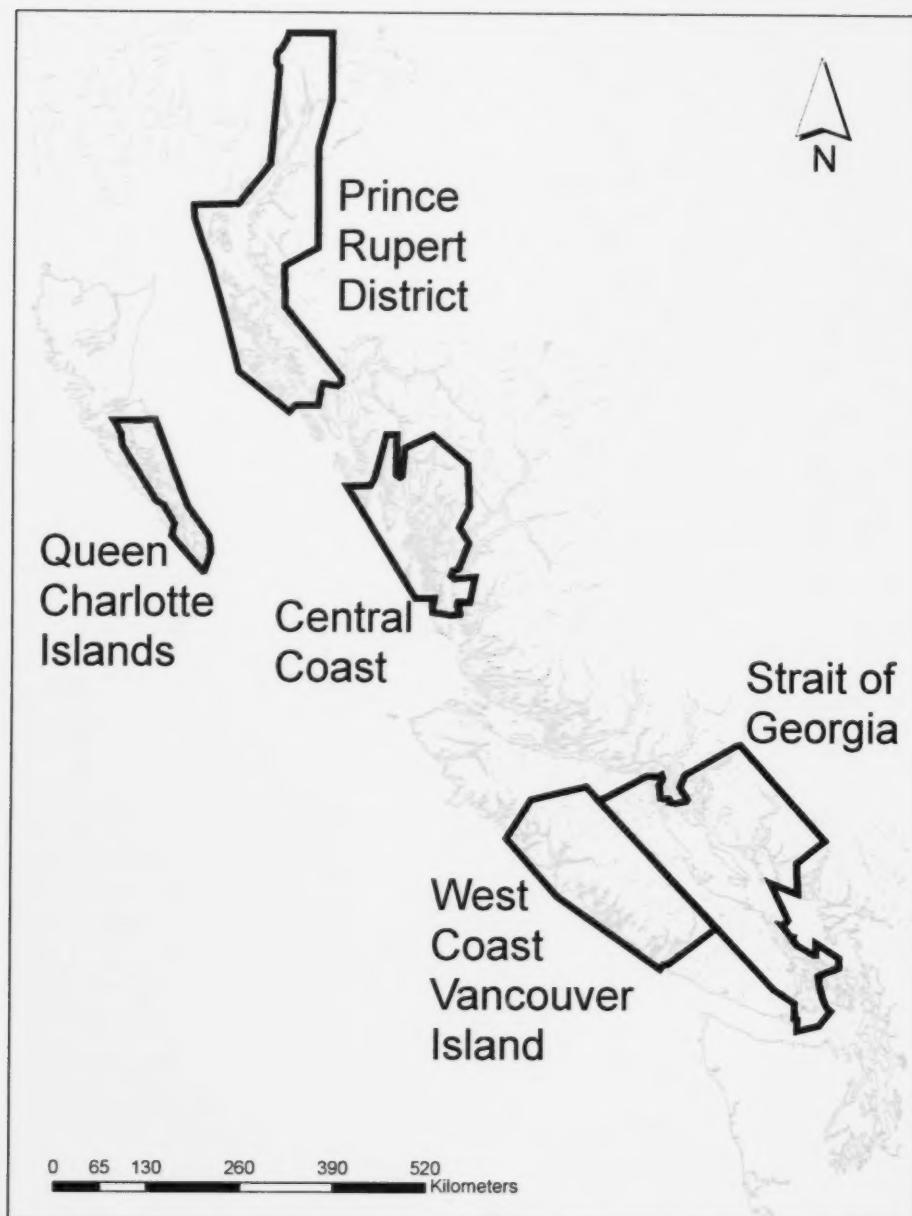


Figure 1. The five major British Columbia herring stock assessment areas.

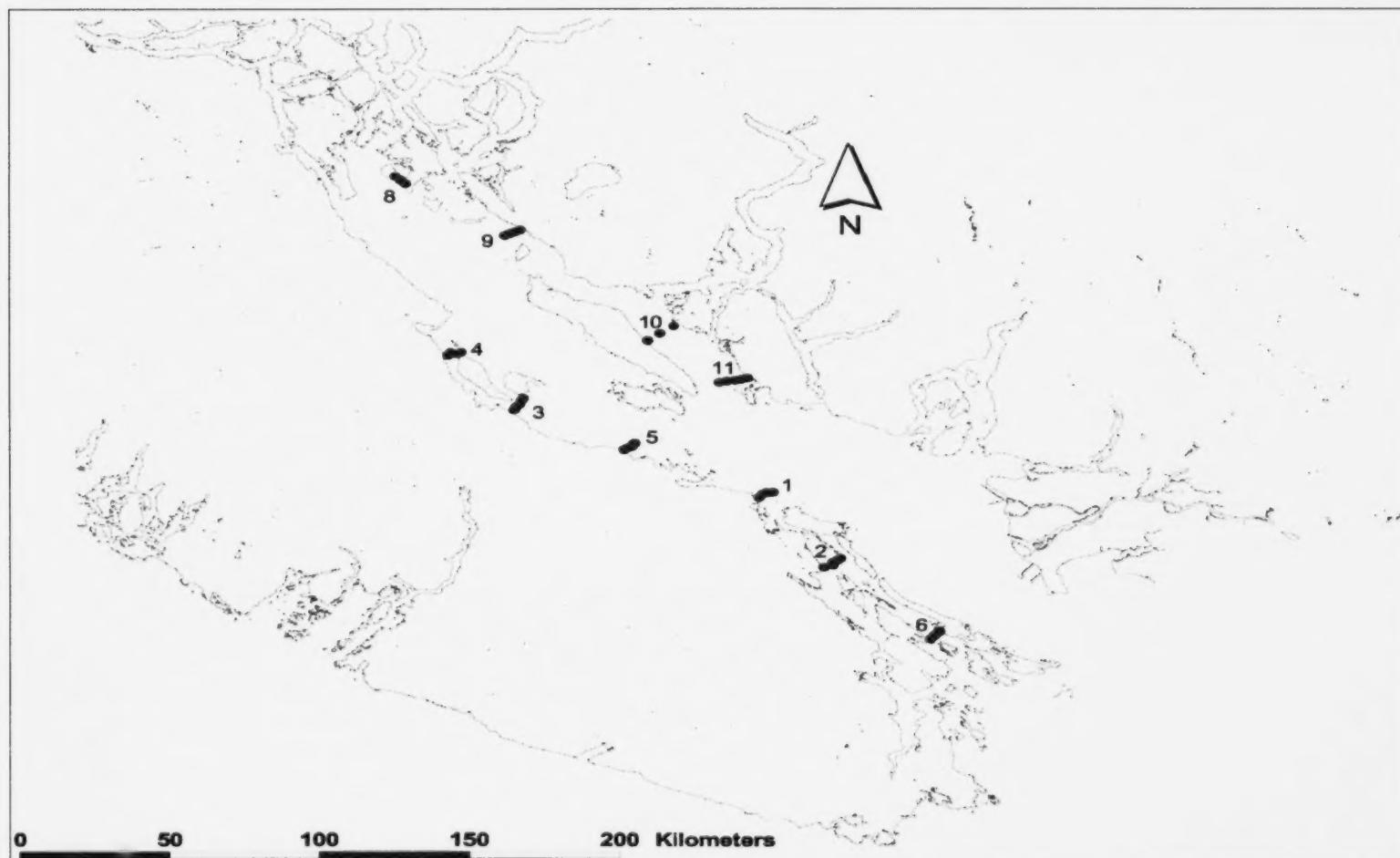


Figure 2. Strait of Georgia purse seine set locations in 2005 (n=46). Transect numbers shown.

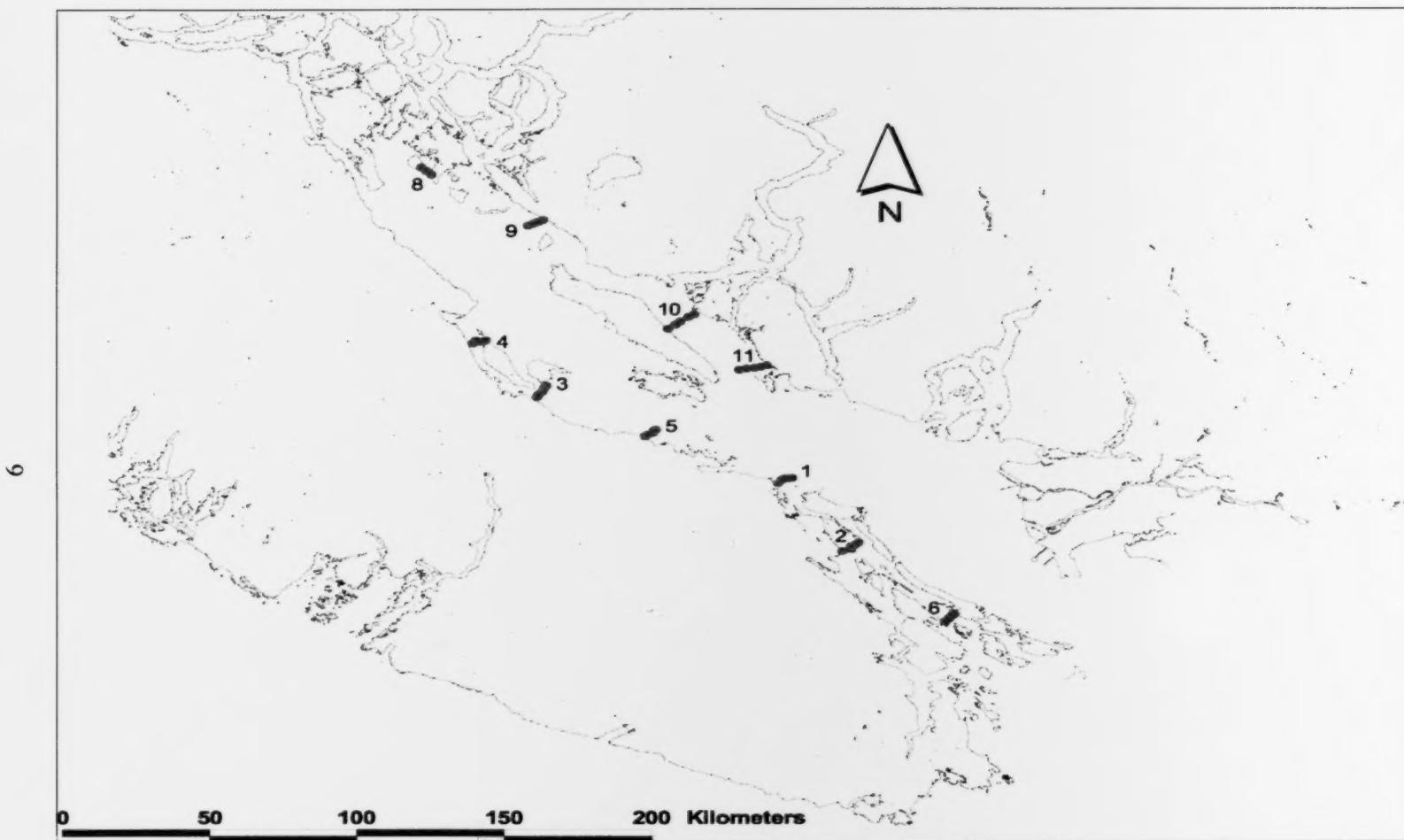


Figure 3. Strait of Georgia purse seine set locations in 2006 (n=48). Transect numbers shown.

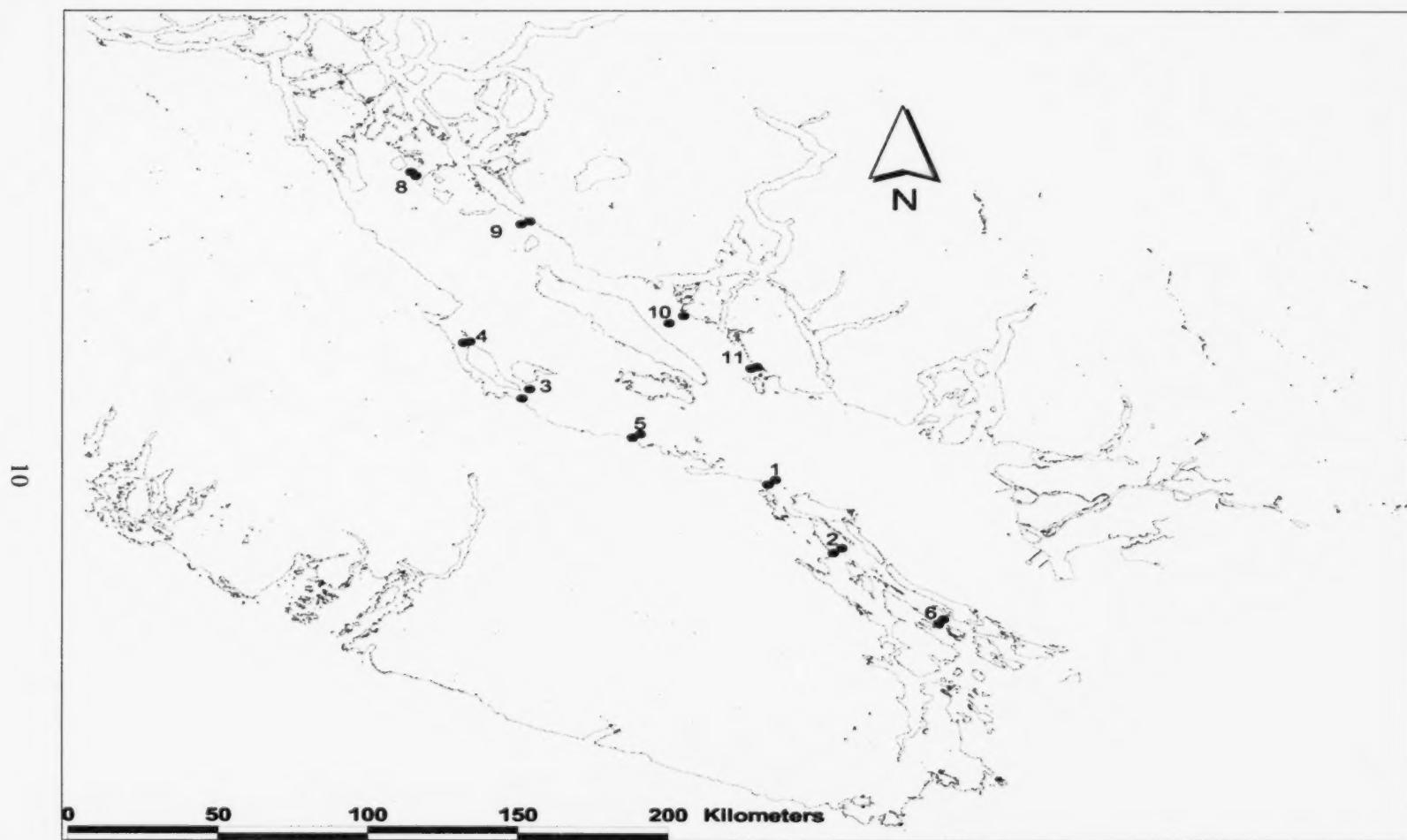


Figure 4. Strait of Georgia plankton tow locations in 2005 (n=20). Transect numbers shown.

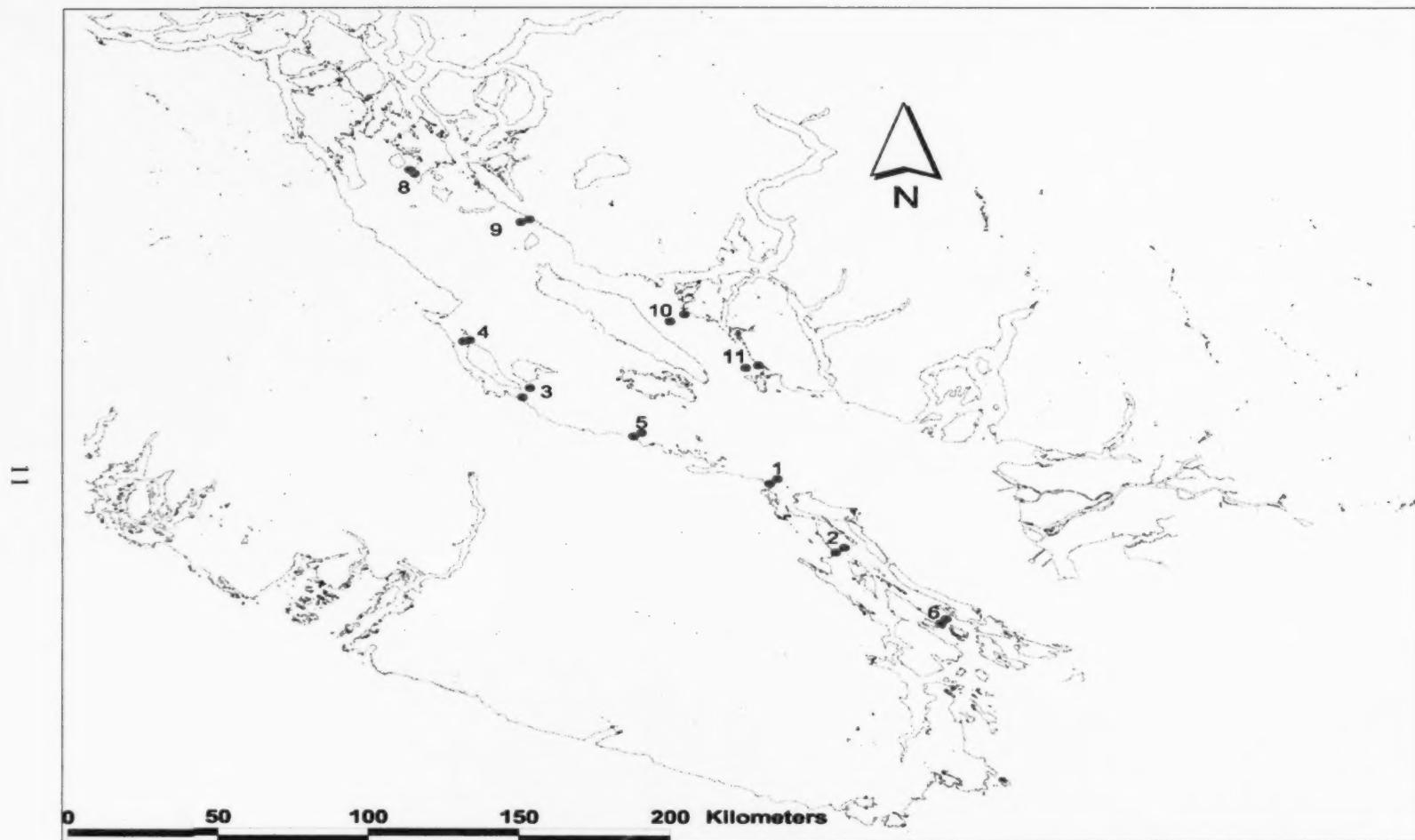


Figure 5. Strait of Georgia plankton tows and CTD cast locations in 2006 (n=20). Transect numbers shown.

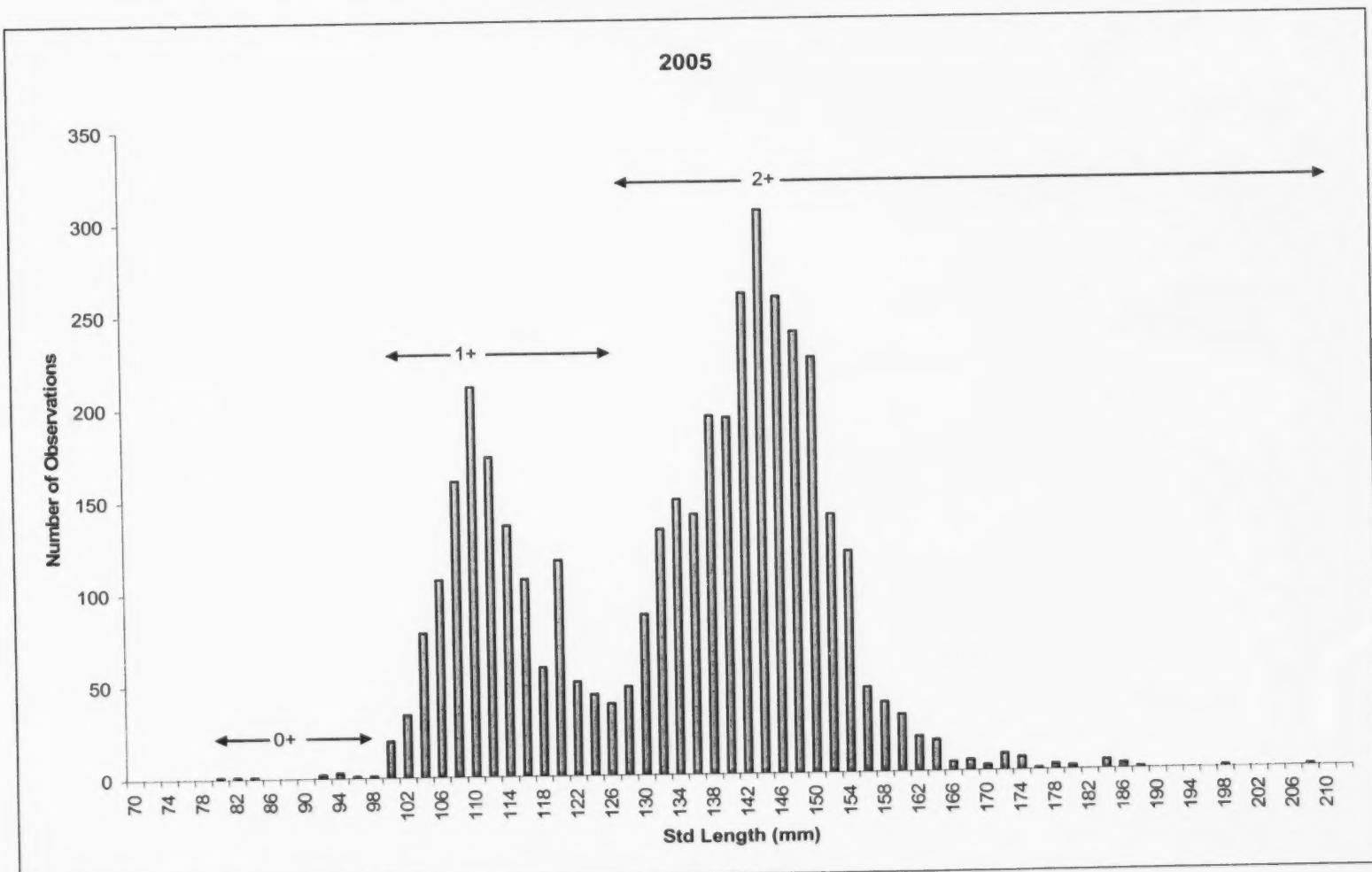


Figure 6. Length-frequency distribution for all sampled herring in 2005 (n=4048).

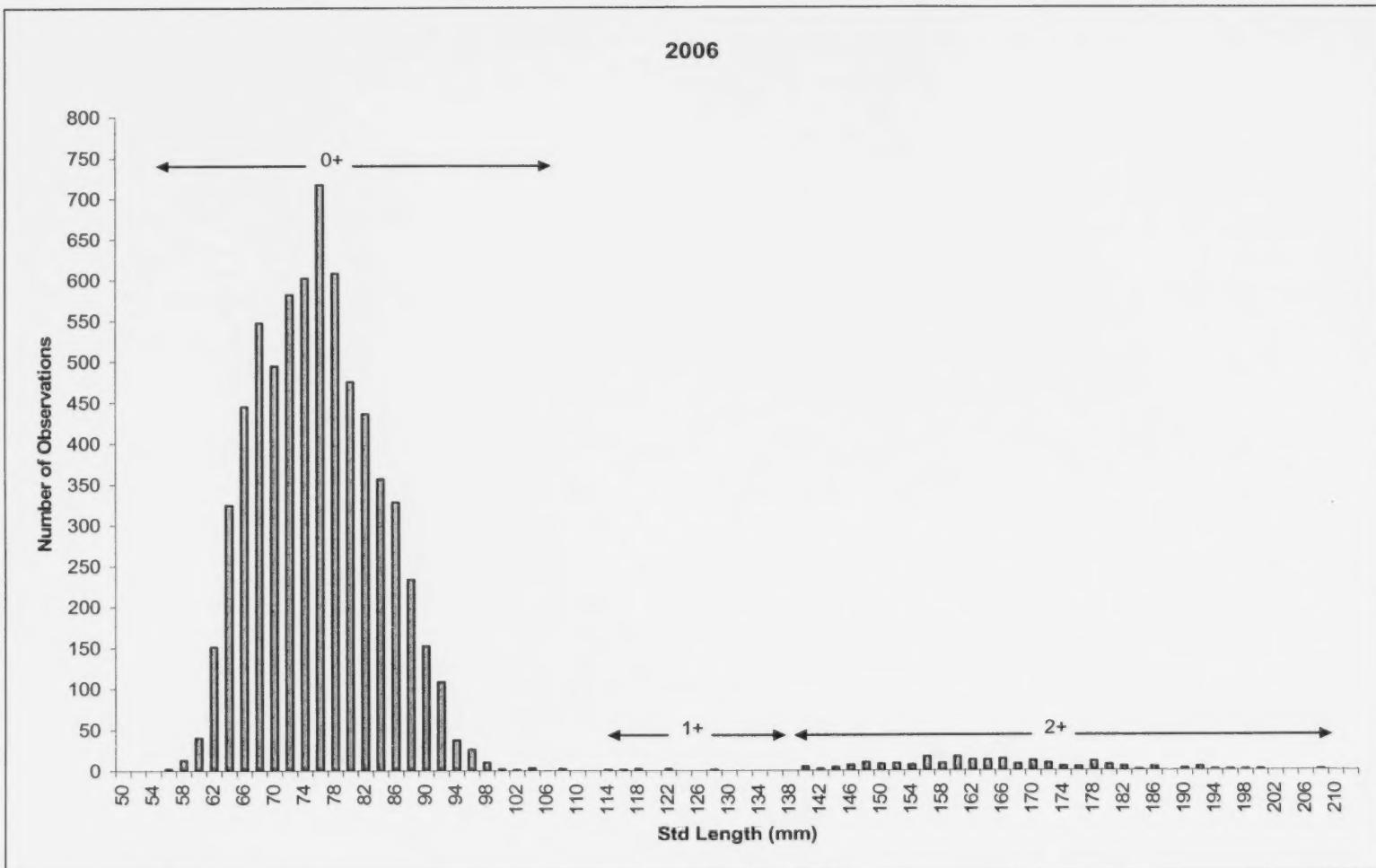
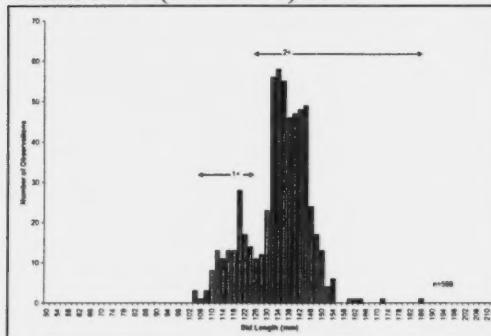
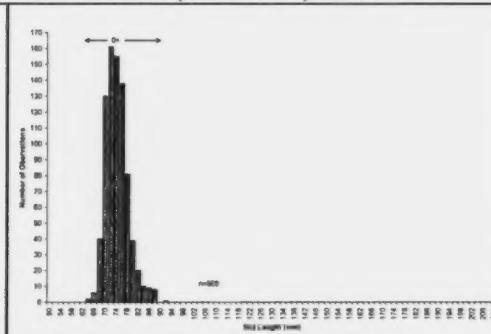


Figure 7. Length-frequency distribution for all sampled herring in 2006 (n=6914).

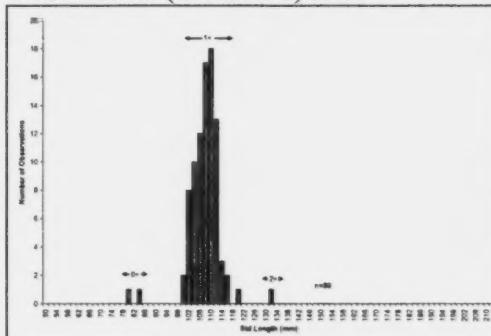
Clarke Rock (Transect 1) 2005



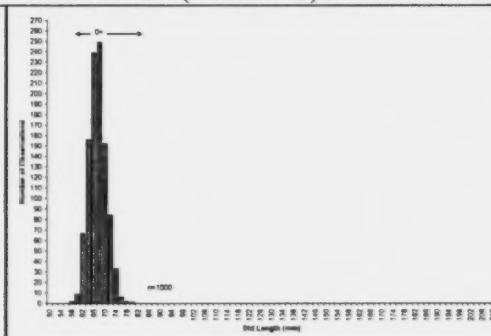
Clarke Rock (Transect 1) 2006



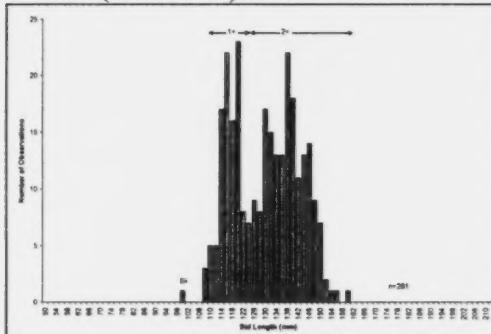
Yellow Point (Transect 2) 2005



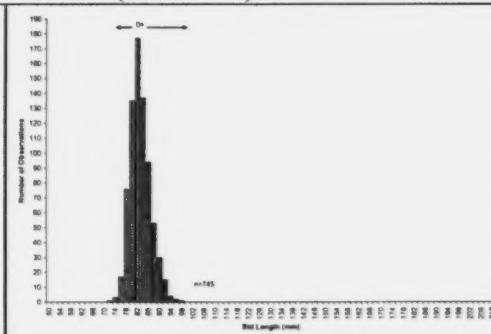
Yellow Point (Transect 2) 2006



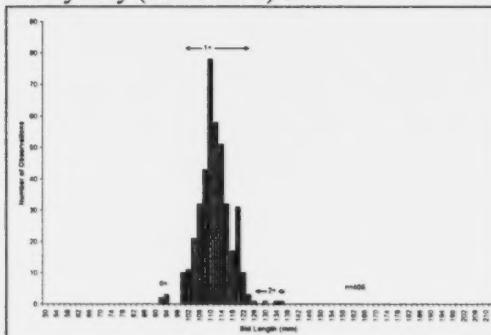
Bowser (Transect 3) 2005



Bowser (Transect 3) 2006



Henry Bay (Transect 4) 2005



Henry Bay (Transect 4) 2006

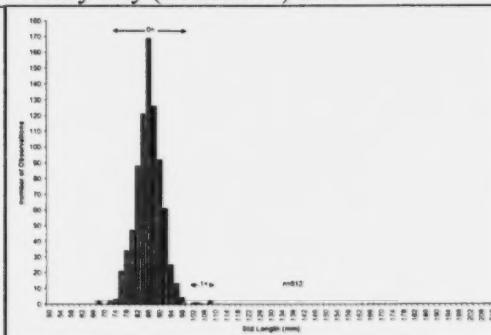
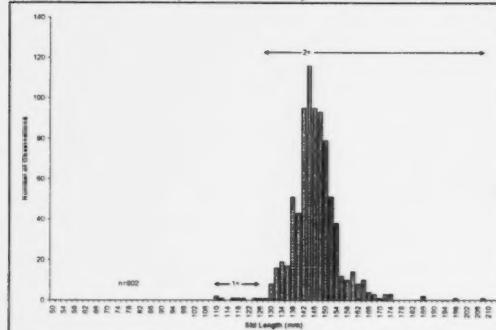
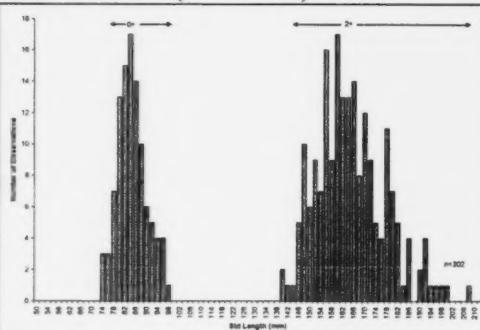


Figure 8. Length-frequency histograms by transect location for 2005 and 2006.

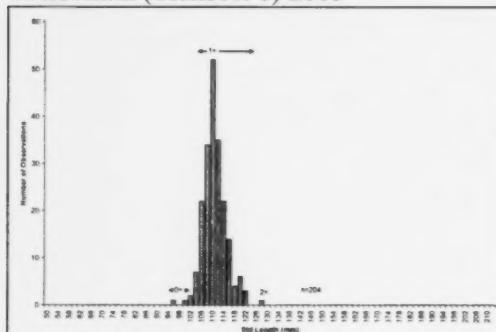
French Creek (Transect 5) 2005



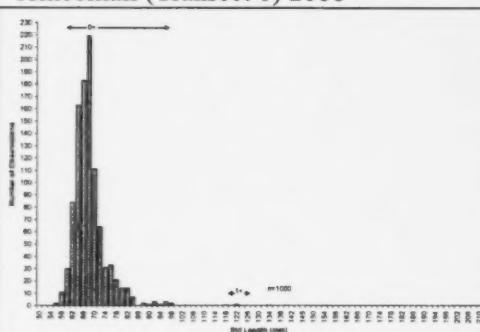
French Creek (Transect 5) 2006



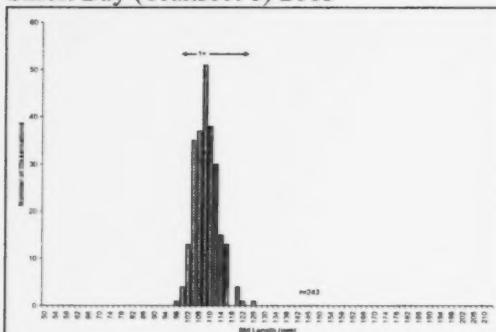
Trincomali (Transect 6) 2005



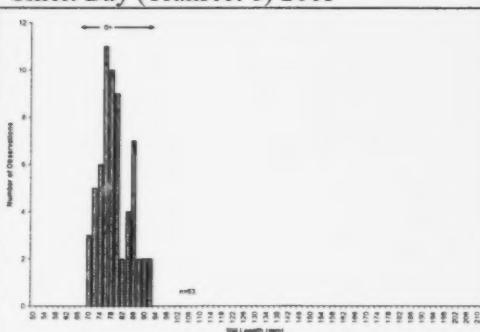
Trincomali (Transect 6) 2006



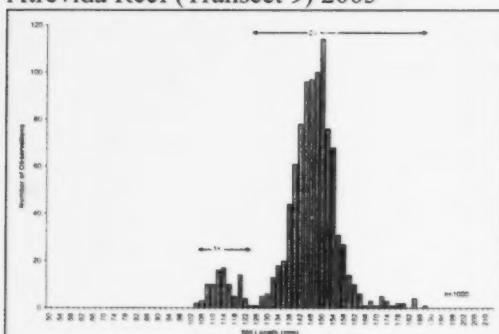
Smelt Bay (Transect 8) 2005



Smelt Bay (Transect 8) 2005



Atrevida Reef (Transect 9) 2005



Atrevida Reef (Transect 9) 2005

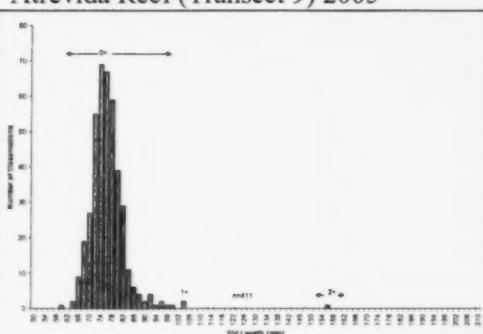
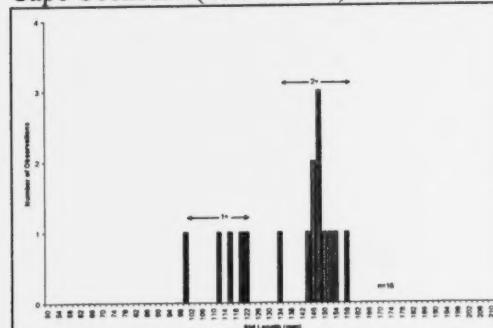
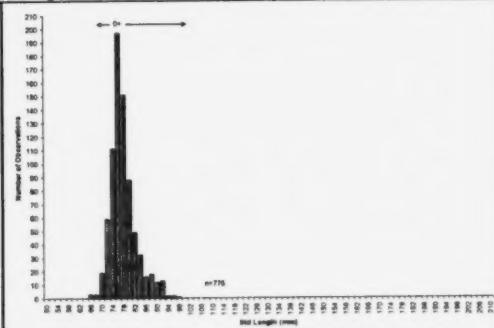


Figure 8 continued...

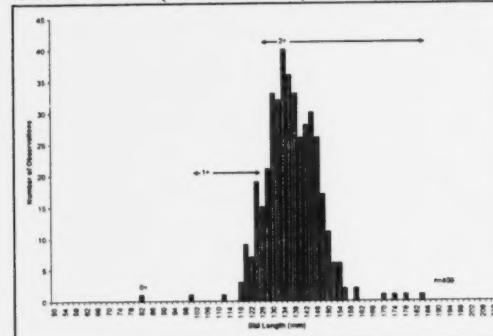
Cape Cockburn (Transect 10) 2005



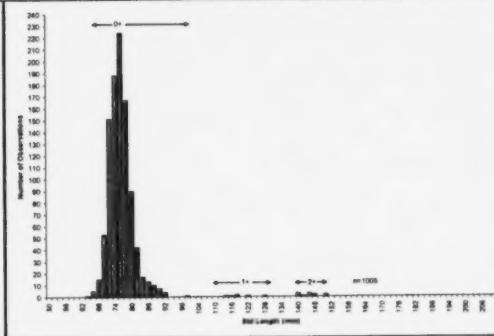
Cape Cockburn (Transect 10) 2005



Secret Cove (Transect 11) 2005



Secret Cove (Transect 11) 2005



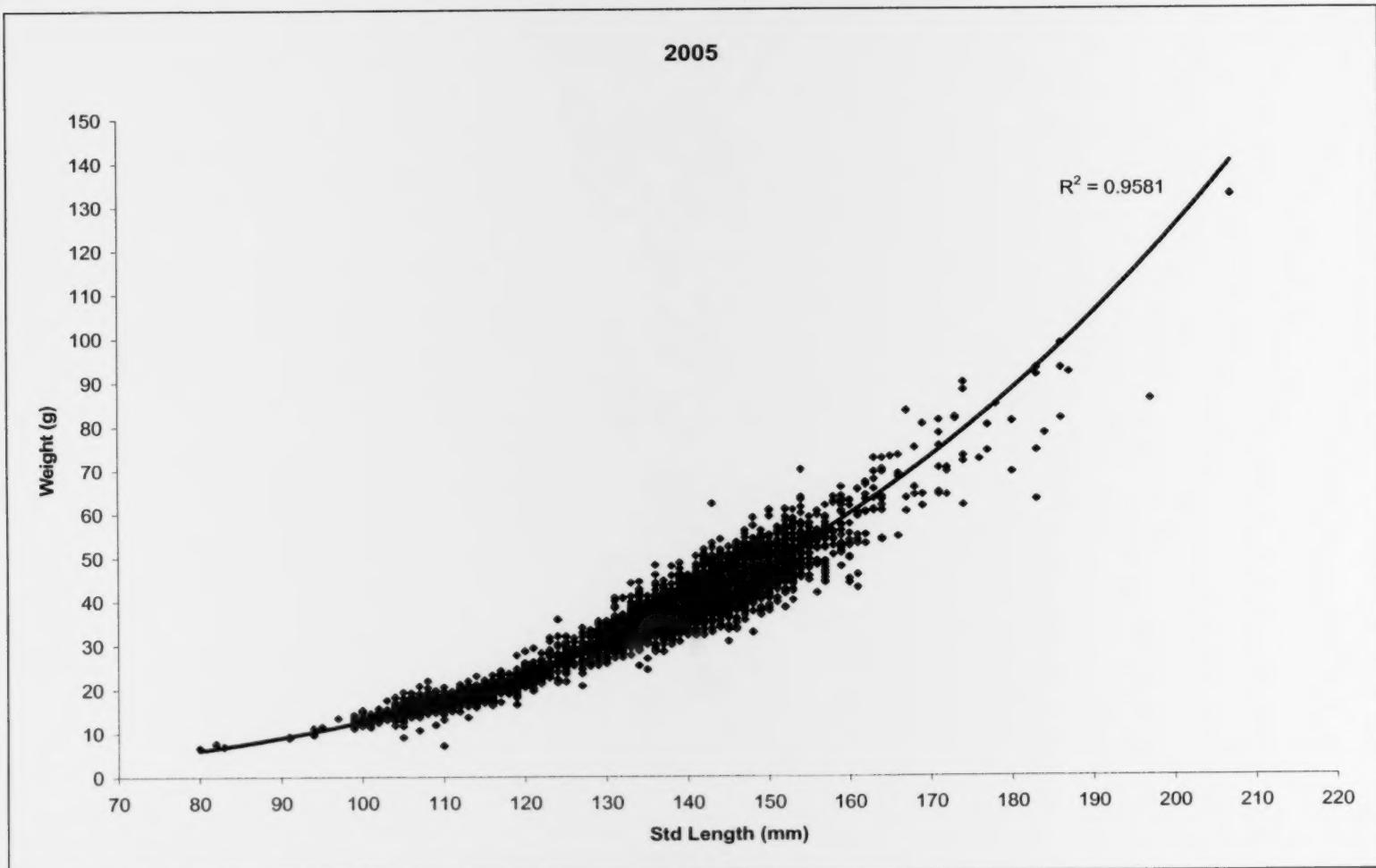


Figure 9. Length-weight relationship for all sampled herring in 2005 (n=4048).

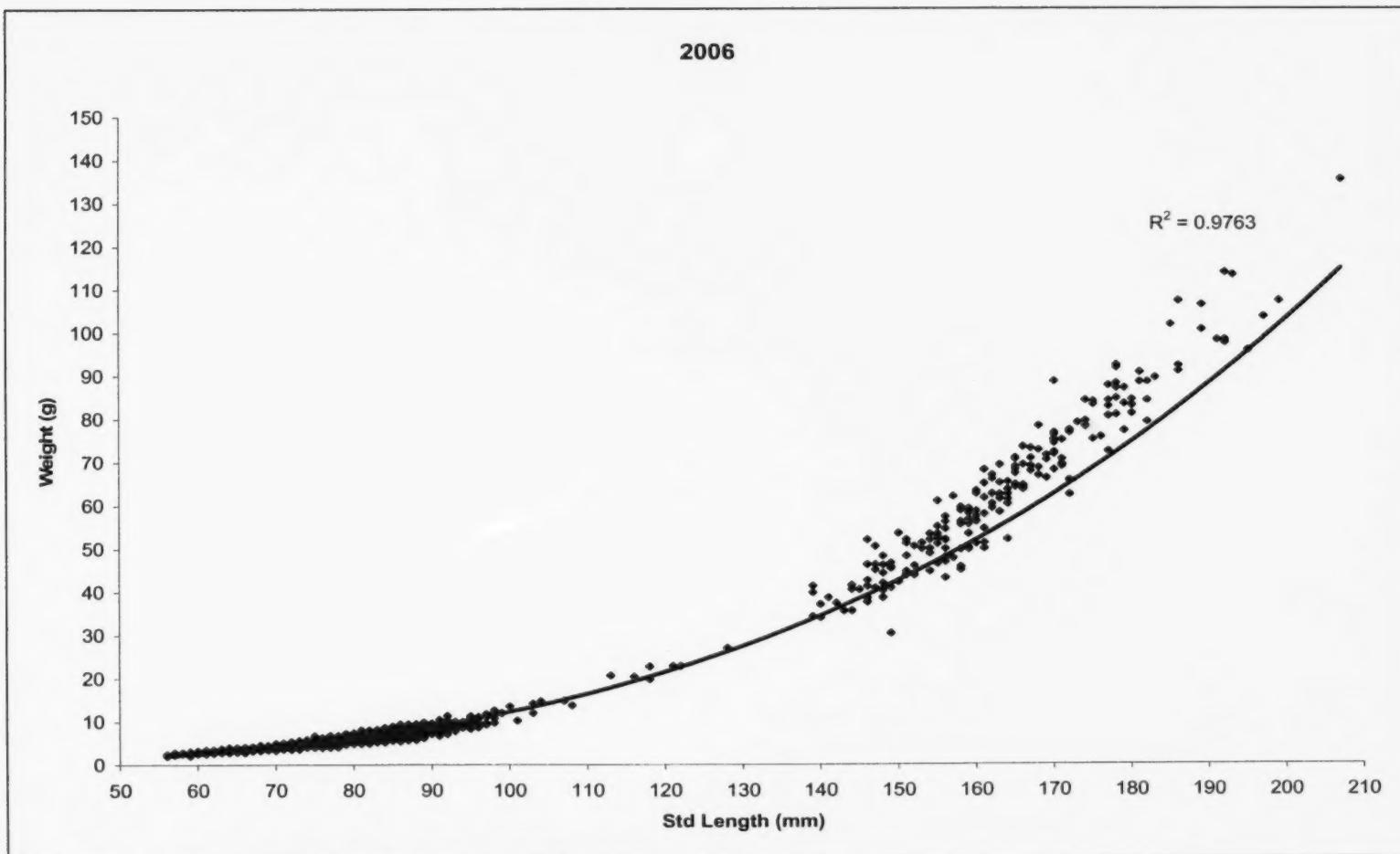


Figure 10. Length-weight relationship for all sampled herring in 2006 (n=6914).

Clarke Rock (Transect 1)

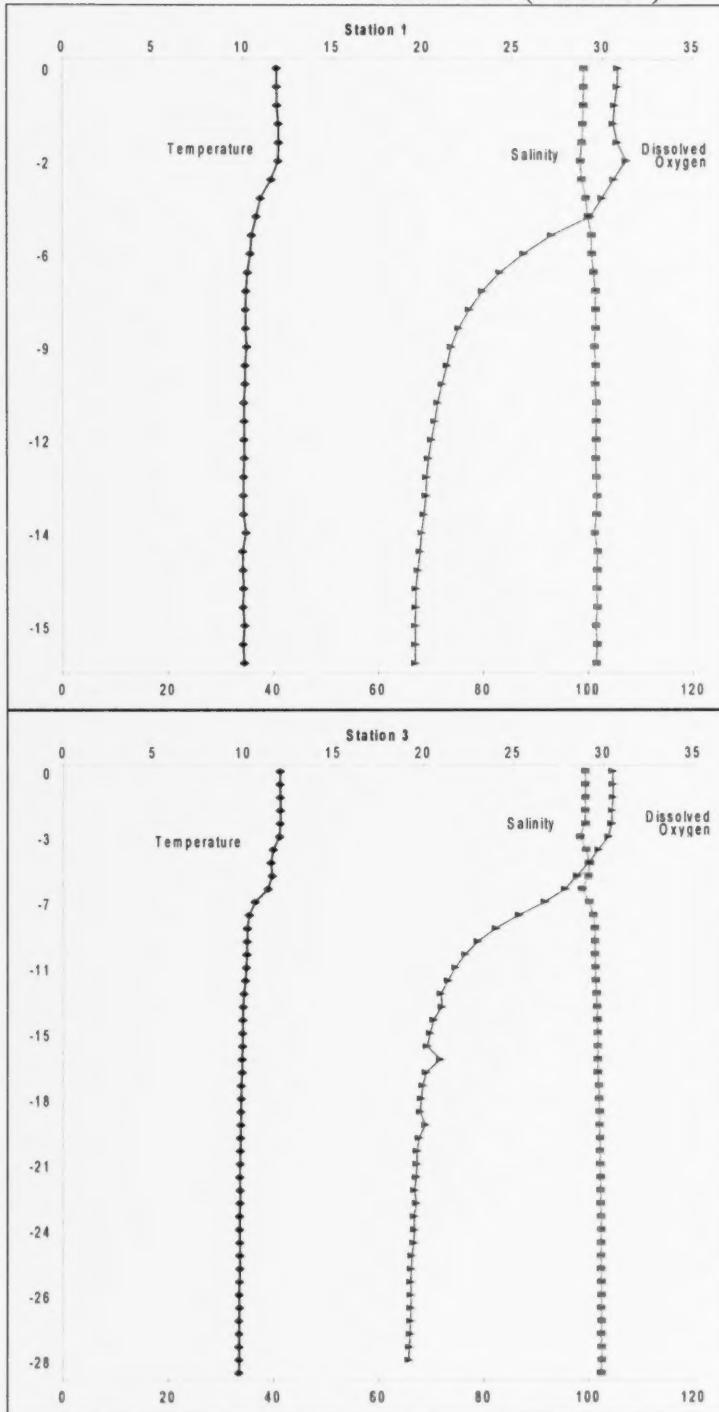


Figure 11. Temperature (°C), Salinity (ppt) and Dissolved Oxygen (%) from Strait of Georgia CTD casts (depth in meters on y-axis) in 2006.

Yellow Point (Transect 2)

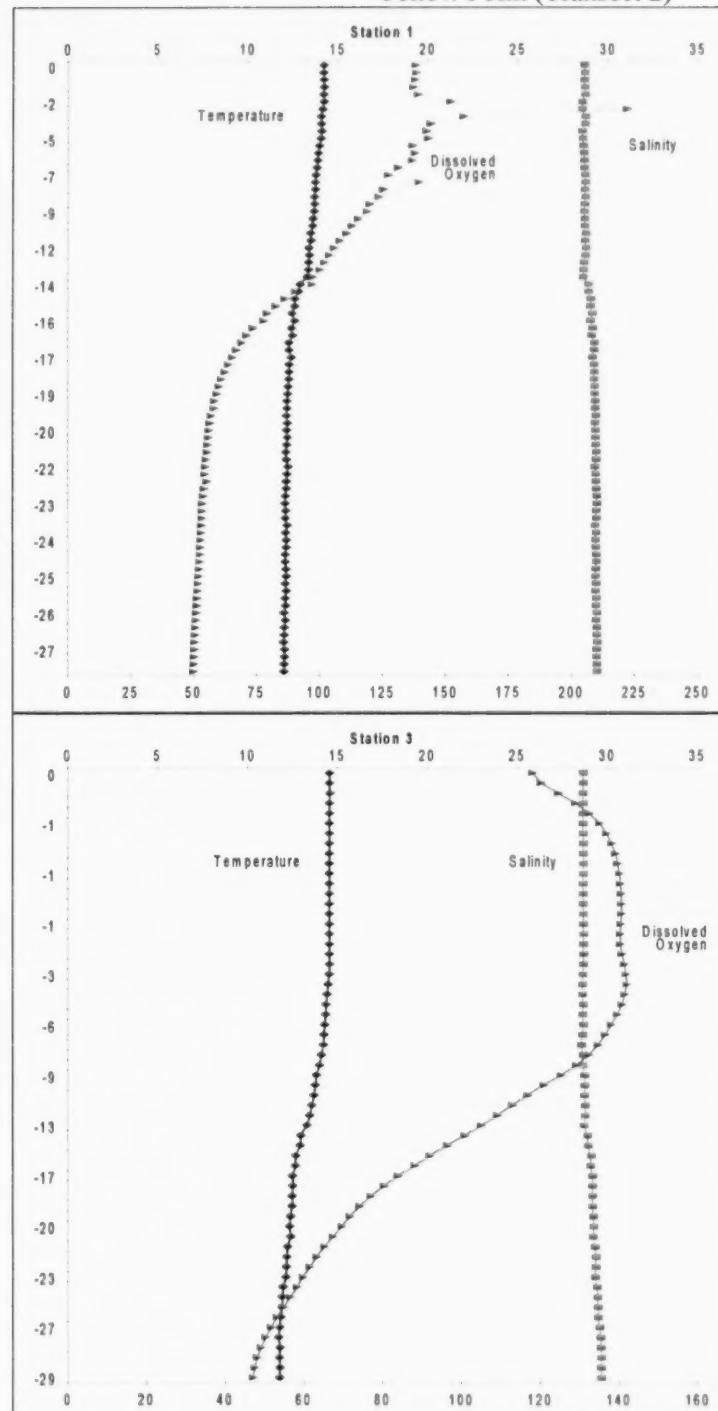


Figure 11 continued...

Bowser (Transect 3)

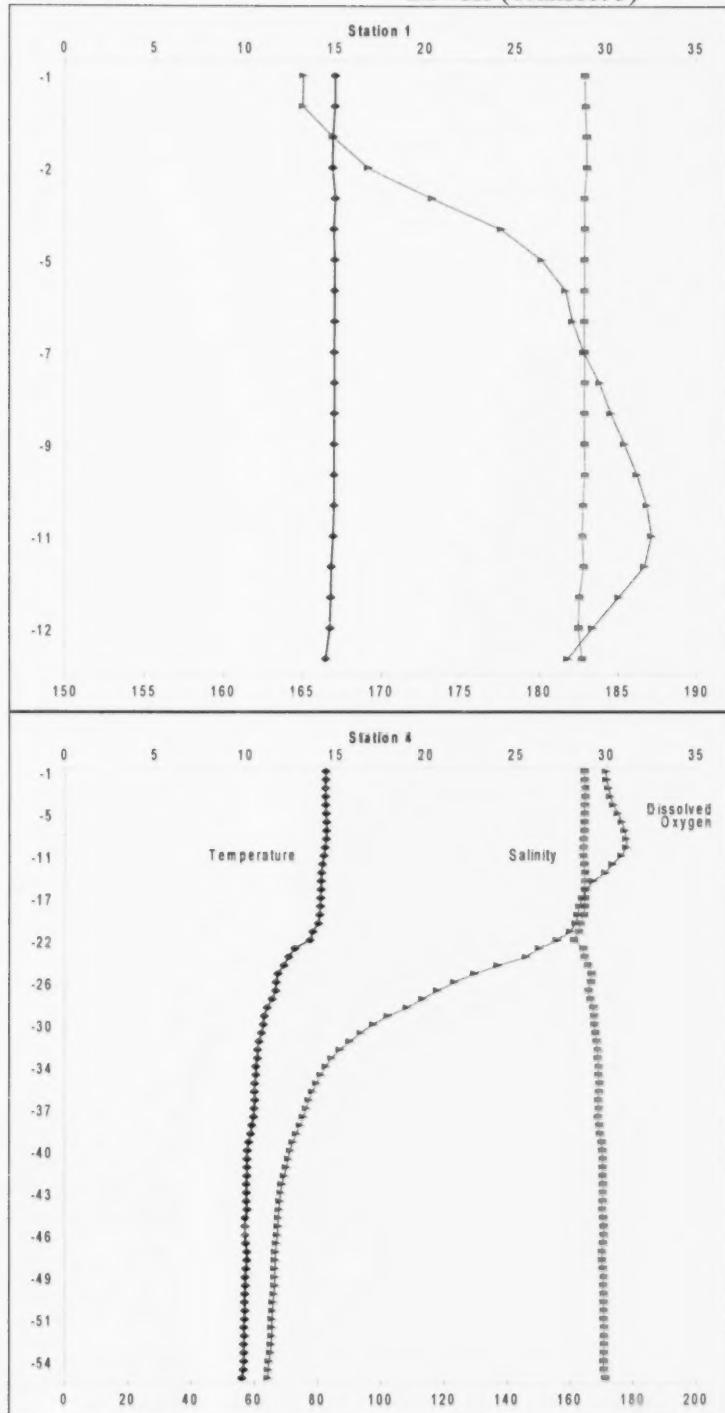


Figure 11 continued...

Henry Bay (Transect 4)

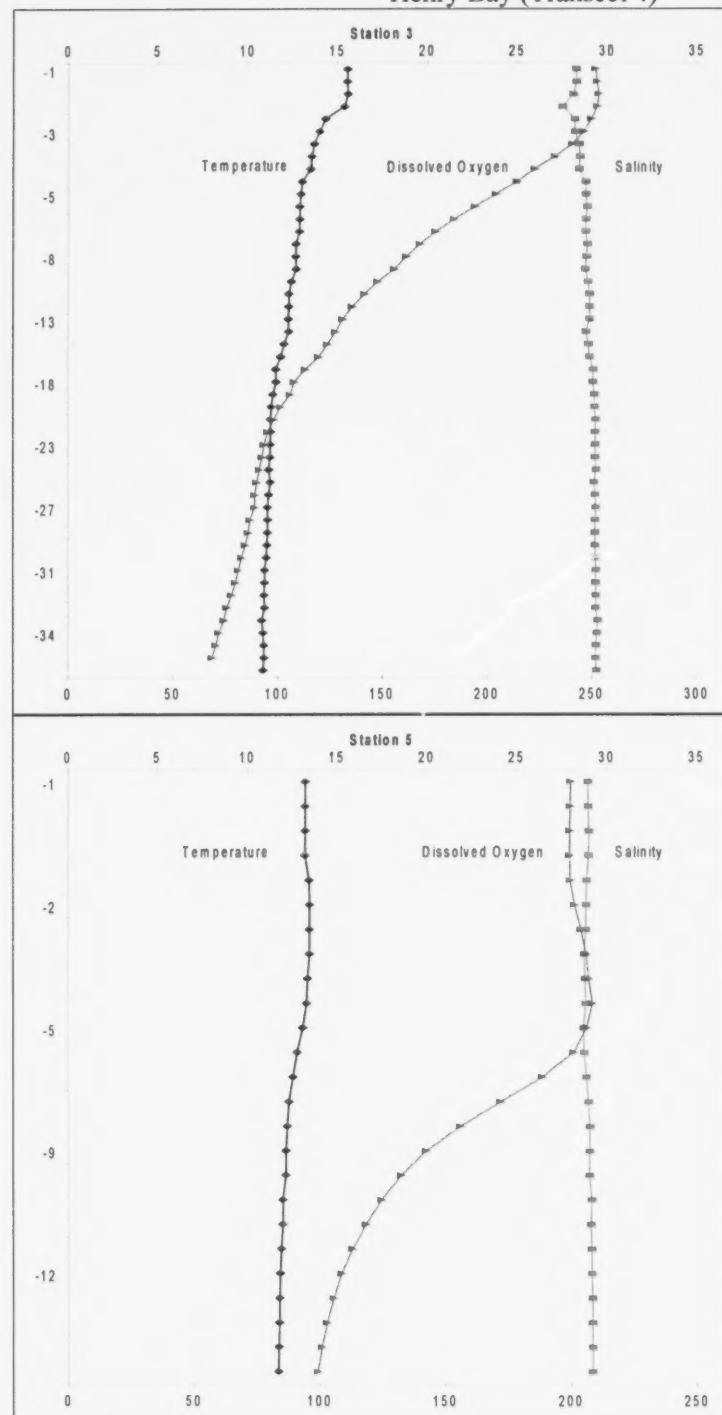


Figure 11 continued...

French Creek (Transect 5)

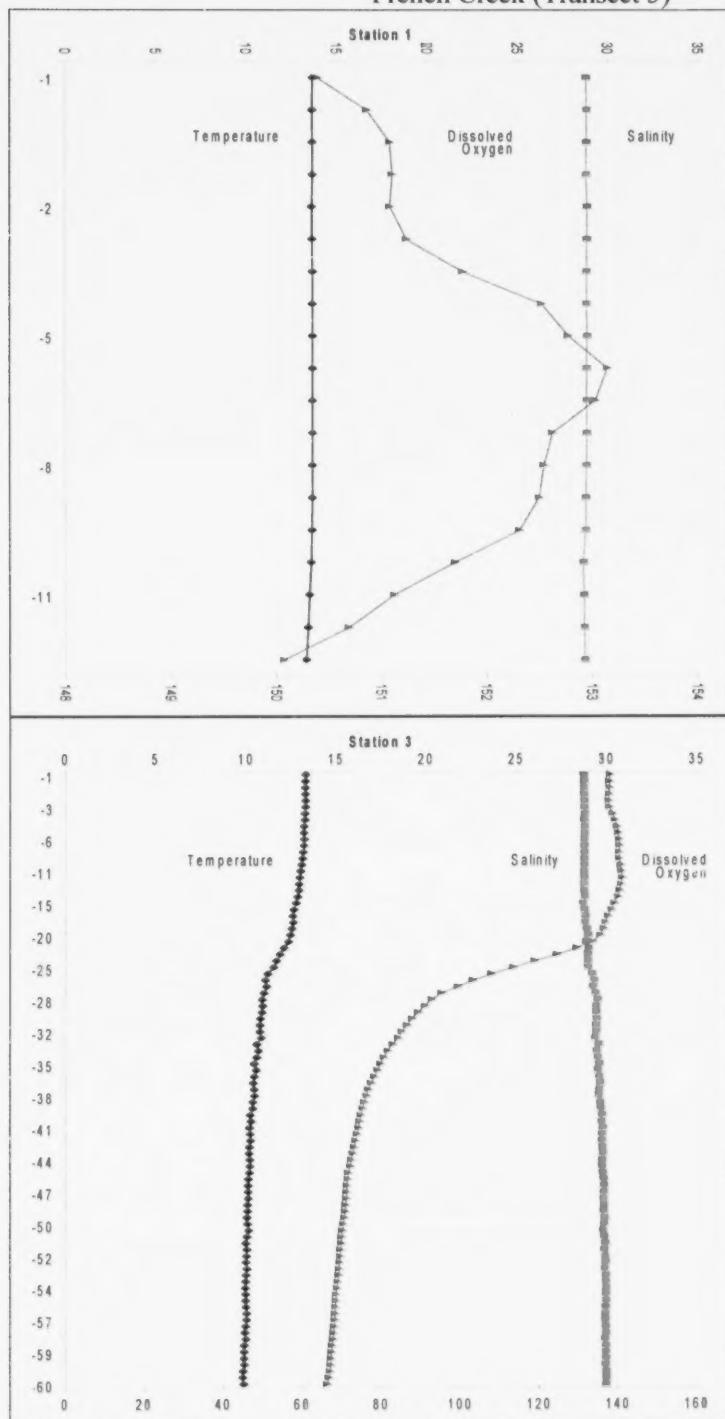


Figure 11 continued...

Trincomali (Transect 6)

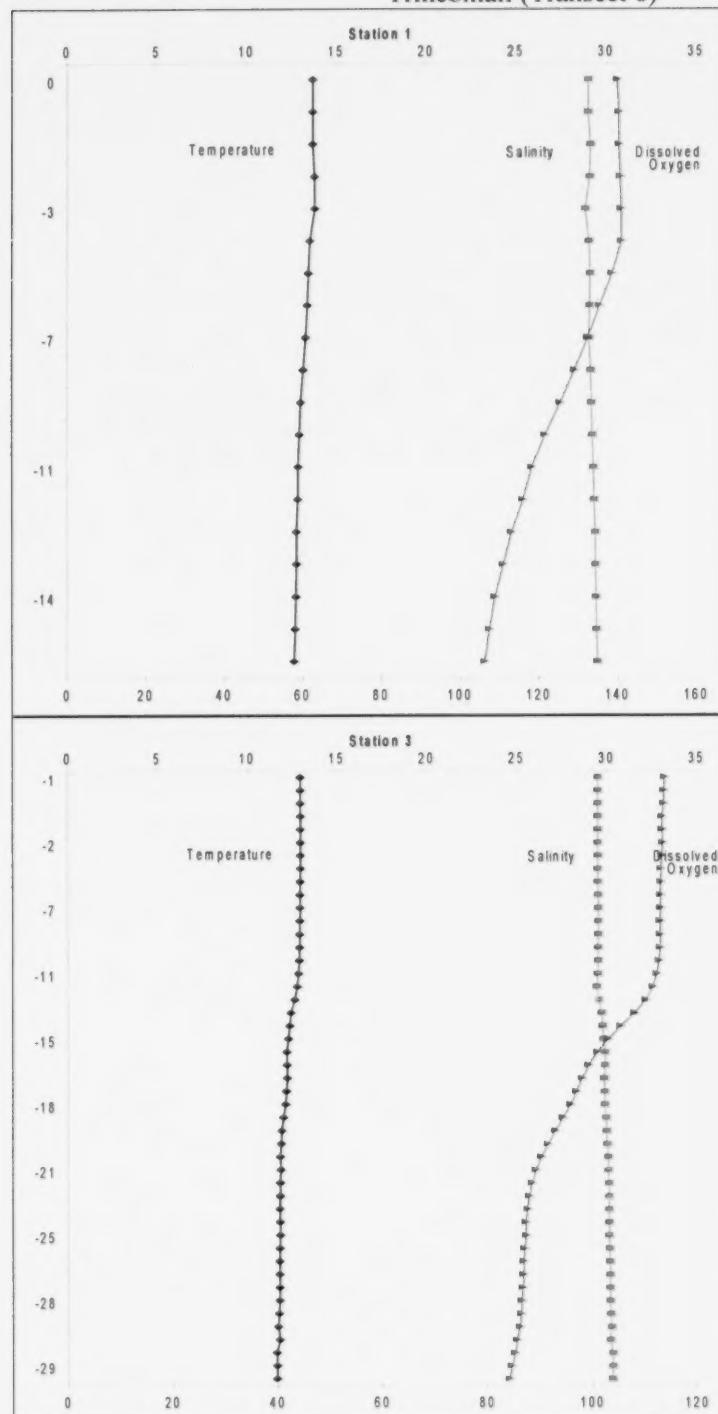


Figure 11 continued...

Smelt Bay (Transect 8)

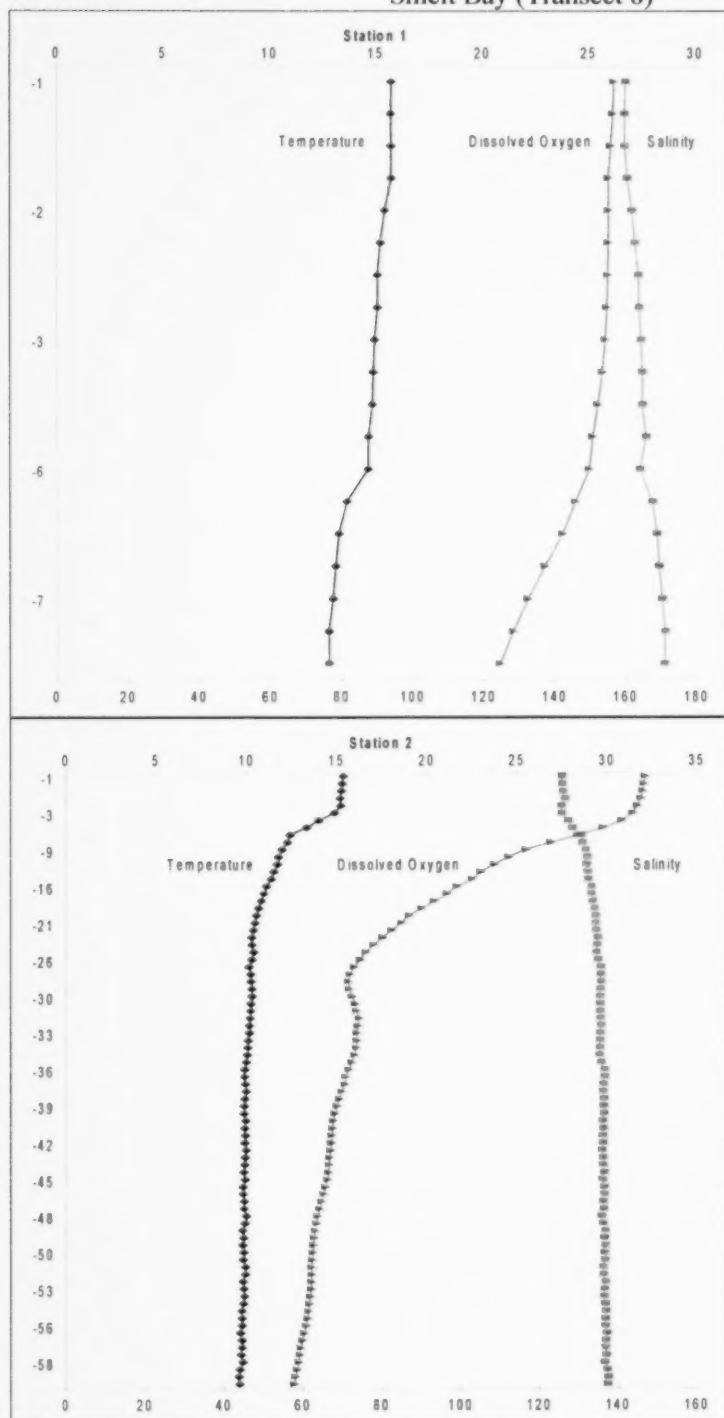


Figure 11 continued...

Atrevida Reef (Transect 9)

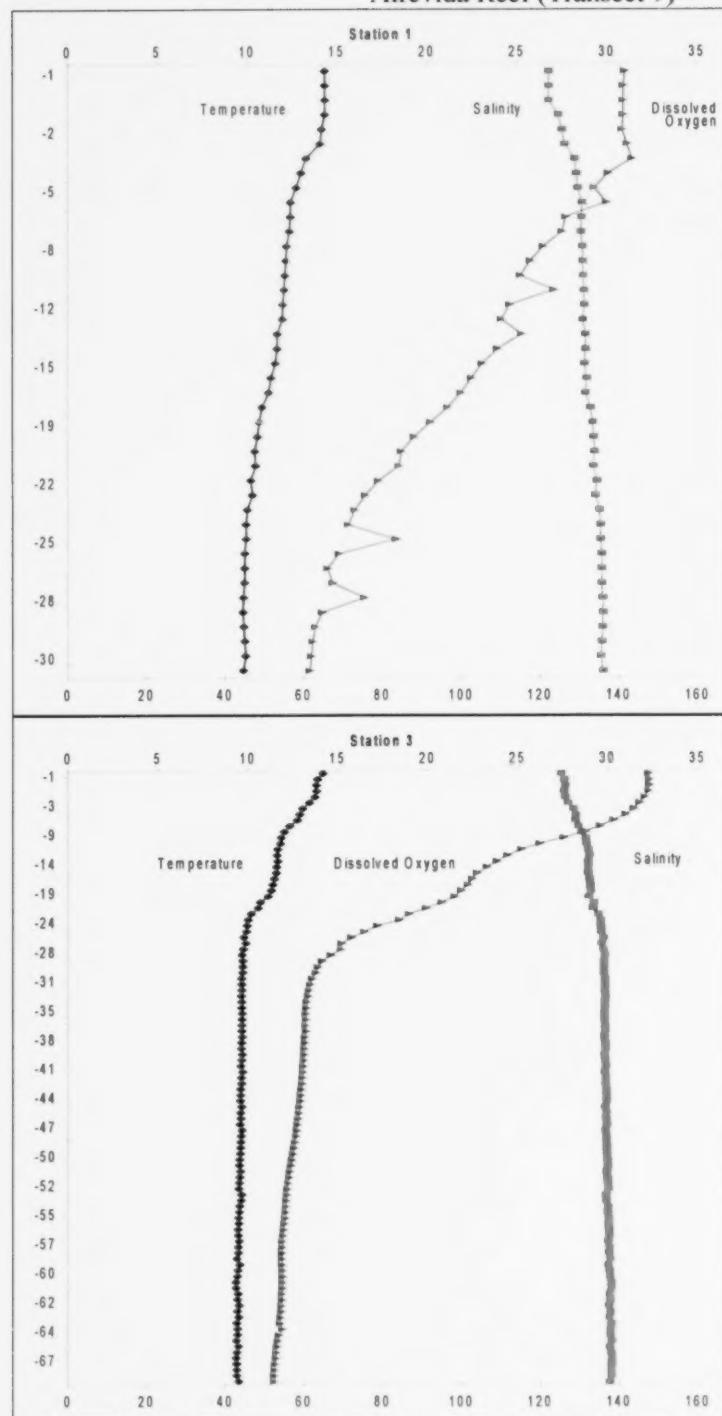


Figure 11 continued...

Cape Cockburn (Transect 10)

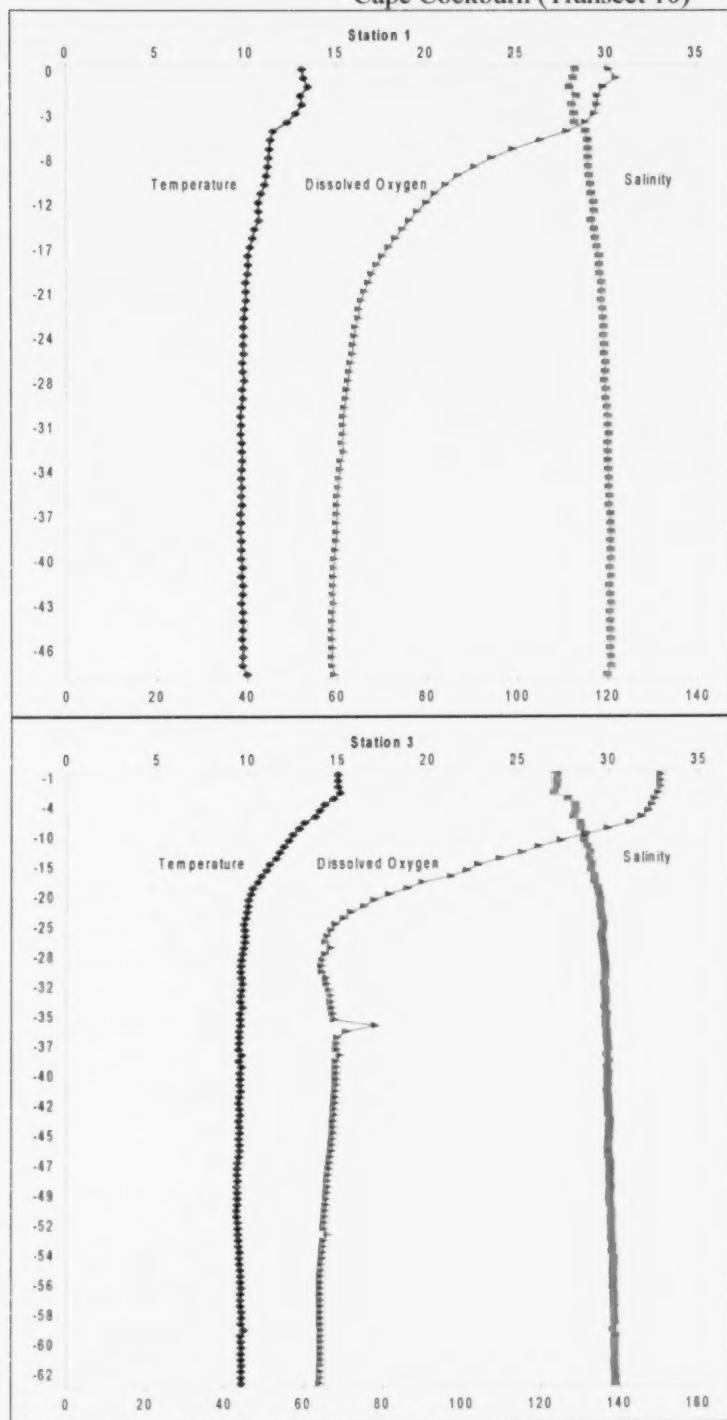


Figure 11 continued...

Secret Cove (Transect 11)

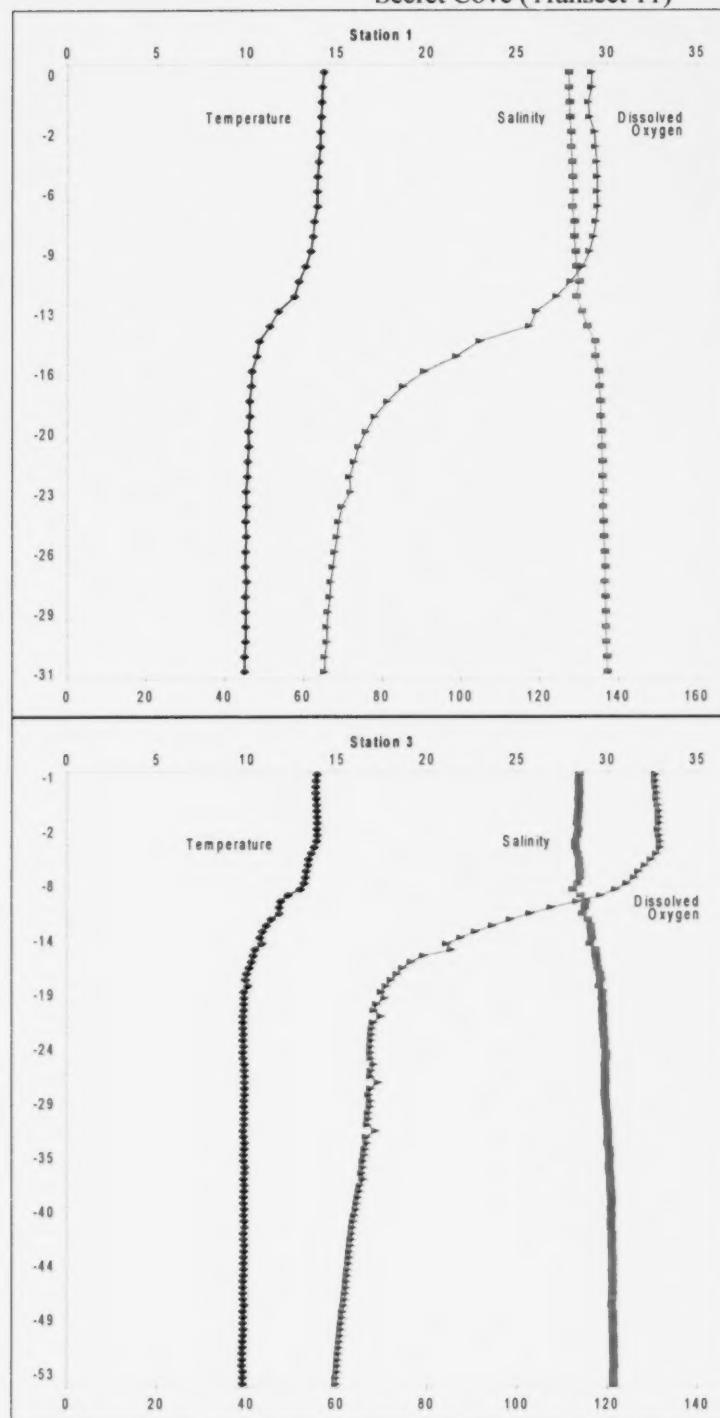


Table 1. Strait of Georgia purse seine set summary for 2005.

Year	Month	Day	Transect	Station	Seine Set Time	Location Name	DD Lat (N)	DD Long (W)
2005	9	19	2	5	2100	Yellow Point	49.0658	123.6983
2005	9	19	2	4	2200	Yellow Point	49.0600	123.7080
2005	9	19	2	3	2245	Yellow Point	49.0558	123.7223
2005	9	19	2	2	2330	Yellow Point	49.0480	123.7220
2005	9	19	2	1	0010	Yellow Point	49.0424	123.7470
2005	9	20	6	1	2005	Trincomali	48.8549	123.4303
2005	9	20	6	2	2040	Trincomali	48.8620	123.4230
2005	9	20	6	3	2105	Trincomali	48.8667	123.4167
2005	9	20	6	4	2130	Trincomali	48.8730	123.4070
2005	9	20	6	5	2200	Trincomali	48.8767	123.4067
2005	9	21	1	5	2005	Clarke Rock	49.2380	123.9020
2005	9	21	1	4	2045	Clarke Rock	49.2370	123.9120
2005	9	21	1	3	2115	Clarke Rock	49.2367	123.9217
2005	9	21	1	2	2155	Clarke Rock	49.2333	123.9317
2005	9	21	1	1	2230	Clarke Rock	49.2236	123.9433
2005	9	22	5	5	2015	French Creek	49.3658	124.3170
2005	9	22	5	4	2045	French Creek	49.3615	124.3230
2005	9	22	5	3	2115	French Creek	49.3575	124.3267
2005	9	22	5	2	2140	French Creek	49.3533	124.3383
2005	9	22	5	1	2210	French Creek	49.3483	124.3500
2005	9	25	3	5	2035	Bowser	49.4820	124.6510
2005	9	25	3	4	2105	Bowser	49.4760	124.6570
2005	9	25	3	3	2135	Bowser	49.4667	124.6633
2005	9	25	3	2	2210	Bowser	49.4592	124.6725
2005	9	25	3	1	2235	Bowser	49.4517	124.6800
2005	9	26	4	1	2000	Henry Bay	49.5933	124.8750
2005	9	26	4	2	2040	Henry Bay	49.6010	124.8658
2005	9	26	4	3	2115	Henry Bay	49.5983	124.8556
2005	9	26	4	4	2150	Henry Bay	49.5980	124.8458
2005	9	26	4	5	2235	Henry Bay	49.6020	124.8362
2005	9	27	8	3	2005	Smelt Bay	50.0541	125.0300
2005	9	27	8	2	2035	Smelt Bay	50.0456	125.0159
2005	9	27	8	1	2105	Smelt Bay	50.0358	125.0000
2005	10	3	9	5	2000	Atrevida Reef	49.9021	124.7065
2005	10	3	9	4	2025	Atrevida Reef	49.9058	124.6943
2005	10	3	9	3	2050	Atrevida Reef	49.9090	124.6838
2005	10	3	9	2	2115	Atrevida Reef	49.9120	124.6734
2005	10	3	9	1	2145	Atrevida Reef	49.9164	124.6594
2005	10	5	10	5	1940	Cape Cockburn	49.6318	124.2781
2005	10	5	10	3	2015	Cape Cockburn	49.6508	124.2417
2005	10	5	10	1	2050	Cape Cockburn	49.6695	124.1981
2005	10	5	11	2	2255	Secret Cove	49.5317	123.9950
2005	10	5	11	1	2325	Secret Cove	49.5350	123.9767
2005	10	5	11	3	0035	Secret Cove	49.5283	124.0142
2005	10	5	11	4	100	Secret Cove	49.5270	124.0400
2005	10	5	11	5	125	Secret Cove	49.5230	124.0600

Table 2. Strait of Georgia purse seine set summary for 2006.

Year	Month	Day	Transect	Station	Seine Set Time	Location Name	DD Lat (N)	DD Long (W)
2006	9	18	2	5	2045	Yellow Point	49.0658	123.6983
2006	9	18	2	4	2123	Yellow Point	49.0600	123.7080
2006	9	18	2	3	2155	Yellow Point	49.0558	123.7223
2006	9	18	2	2	2225	Yellow Point	49.0480	123.7220
2006	9	18	2	1	2255	Yellow Point	49.0424	123.7470
2006	9	19	6	1	2020	Trincomali	48.8549	123.4303
2006	9	19	6	2	2050	Trincomali	48.8620	123.4230
2006	9	19	6	3	2125	Trincomali	48.8667	123.4167
2006	9	19	6	4	2147	Trincomali	48.8730	123.4070
2006	9	19	6	5	2210	Trincomali	48.8767	123.4067
2006	9	20	1	1	2015	Clarke Rock	49.2236	123.9433
2006	9	20	1	2	2040	Clarke Rock	49.2333	123.9317
2006	9	20	1	3	2110	Clarke Rock	49.2367	123.9217
2006	9	20	1	4	2132	Clarke Rock	49.2370	123.9120
2006	9	20	1	5	2200	Clarke Rock	49.2380	123.9020
2006	9	24	11	5	2020	Secret Cove	49.5230	124.0600
2006	9	24	11	4	2048	Secret Cove	49.5270	124.0400
2006	9	24	11	3	2125	Secret Cove	49.5283	124.0142
2006	9	24	11	2	2153	Secret Cove	49.5317	123.9950
2006	9	24	11	1	2220	Secret Cove	49.5350	123.9767
2006	9	25	10	5	2027	Cape Cockburn	49.6318	124.2781
2006	9	25	10	4	2055	Cape Cockburn	49.6420	124.2550
2006	9	25	10	3	2125	Cape Cockburn	49.6508	124.2417
2006	9	25	10	2	2155	Cape Cockburn	49.6620	124.2180
2006	9	25	10	1	2230	Cape Cockburn	49.6695	124.1981
2006	9	26	9	1	2025	Atrevida Reef	49.9164	124.6594
2006	9	26	9	2	2051	Atrevida Reef	49.9120	124.6734
2006	9	26	9	3	2117	Atrevida Reef	49.9090	124.6838
2006	9	26	9	4	2145	Atrevida Reef	49.9058	124.6943
2006	9	26	9	5	2210	Atrevida Reef	49.9021	124.7065
2006	9	27	8	3	2018	Smelt Bay	50.0541	125.0300
2006	9	27	8	2	2045	Smelt Bay	50.0456	125.0159
2006	9	27	8	1	2118	Smelt Bay	50.0358	125.0000
2006	9	28	4	5	2024	Henry Bay	49.6020	124.8362
2006	9	28	4	4	2052	Henry Bay	49.5980	124.8458
2006	9	28	4	3	2117	Henry Bay	49.5983	124.8556
2006	9	28	4	2	2143	Henry Bay	49.6010	124.8658
2006	9	28	4	1	2213	Henry Bay	49.5933	124.8750
2006	10	2	3	5	2010	Bowser	49.4820	124.6510
2006	10	2	3	4	2033	Bowser	49.4760	124.6570
2006	10	2	3	3	2058	Bowser	49.4667	124.6633
2006	10	2	3	2	2125	Bowser	49.4592	124.6725
2006	10	2	3	1	2150	Bowser	49.4517	124.6800
2006	10	3	5	1	2005	French Creek	49.3483	124.3500
2006	10	3	5	2	2033	French Creek	49.3533	124.3383
2006	10	3	5	3	2100	French Creek	49.3575	124.3267

Table 2 continued...

Year	Month	Day	Transect	Station	Seine		DD Lat (N)	DD Long (W)
					Set Time	Location Name		
2006	10	3	5	4	2122	French Creek	49.3615	124.3230
2006	10	3	5	5	2147	French Creek	49.3658	124.3170

Table 3. Species number and weight by transect and station for 2005.

Transect	Station	Location Name	Species	Number	Weight (kg)*
1	1	Clarke Rock	Pacific herring Age-1+	82	1.68
			Pacific herring Age-2+	42	1.49
			Chum salmon	3	0.22
			Pipefish	1	trace
			Poacher	1	trace
			Squid		1.20
1	2	Clarke Rock	Pacific herring Age-1+	25	0.56
			Pacific herring Age-2+	41	1.48
			Chum salmon	5	0.56
			Northern Anchovy	1	0.01
			Squid		0.06
1	3	Clarke Rock	Pacific herring Age-1+	35	0.91
			Pacific herring Age-2+	501	20.19
			Chum salmon	5	0.75
			Squid		0.09
1	4	Clarke Rock	Pacific herring Age-1+	28	0.74
			Pacific herring Age-2+	424	17.36
			Chum salmon	4	0.48
			Juvenile Pollock	1	trace
			Squid		0.62
1	5	Clarke Rock	Pacific herring Age-1+	2	0.04
			Pacific herring Age-2+	6	0.21
			Gunnel	1	0.02
			Squid		0.10
2	1	Yellow Point	Pacific herring Age-0+	3	0.03
			Pacific herring Age-1+	33	0.52
			Midshipman	13	0.01
			Chinook salmon	1	0.07
			Pipefish	2	trace
			Three-spine stickleback	1	trace
			Squid		
2	2	Yellow Point	Pacific herring Age-1+	41	0.66
			Pacific herring Age-2+	1	0.03
			Three-spine stickleback	1	trace
			Jellyfish		7.00
			Squid		7.00
2	3	Yellow Point	Northern Anchovy	15	0.04
			Chinook salmon	1	0.10
			Squid		5.00

* Weights ≤ 9 g referred to as trace.

Table 3 continued...

Transect	Station	Location Name	Species	Number	Weight (kg)*
2	4	Yellow Point	Pacific herring Age-0+	1	0.01
			Pacific herring Age-1+	5	0.07
			Chinook salmon	1	0.07
			Northern Anchovy	1	0.02
2	5	Yellow Point	Pacific herring Age-1+	5	0.08
			Northern Anchovy	69	0.20
			Squid		24.60
3	1	Bowser	Pacific herring Age-1+	95	1.96
			Pacific herring Age-2+	5	0.14
			Flatfish	8	0.13
			Midshipman	7	0.02
			Gunnel	3	0.02
			Shiner perch	3	0.07
			Juvenile Pollock	3	0.15
			Sandlance	2	0.02
3	2	Bowser	Pacific herring Age-1+	2	0.04
			Pacific herring Age-2+	1	0.04
			Northern Anchovy	3	0.01
			Gunnel	1	0.01
			Midshipman		0.20
			Jellyfish		3.49
			Squid		0.49
3	3	Bowser	Pacific herring Age-1+	5	0.11
			Pacific herring Age-2+	35	1.27
			Juvenile Pollock	4	0.03
			Northern Anchovy	2	0.03
			Midshipman		1.68
			Squid		0.28
3	4	Bowser	Pacific herring Age-0+	1	0.01
			Pacific herring Age-1+	9	0.20
			Pacific herring Age-2+	115	4.23
			Northern Anchovy	5	0.02
			Juvenile Pollock	4	0.05
			Chinook salmon	1	0.06
			Midshipman		2.73
			Jellyfish		1.01
			Squid		2.37

Table 3 continued...

Transect	Station	Location Name	Species	Number	Weight (kg)*
3	5	Bowser	Pacific herring Age-2+	1	0.04
			Gunnel	1	0.01
			Juvenile Pollock	1	0.02
			Midshipman		1.03
			Jellyfish		0.43
			Squid		0.41
4	1	Henry Bay	Pacific herring Age-1+	3	0.05
			Pacific herring Age-2+	1	0.03
			Northern Anchovy	4	0.03
			Flatfish	1	0.08
			Midshipman	1	trace
4	2	Henry Bay	Pacific herring Age-0+	3	0.05
			Pacific herring Age-1+	66	1.22
			Northern Anchovy	1842	10.27
			Midshipman	6	0.02
4	3	Henry Bay	Pacific herring Age-1+	27	0.49
			Pacific herring Age-2+	1	0.03
			Northern Anchovy	10	0.06
			Midshipman	10	0.07
			Gunnel	4	0.03
			Three-spine stickleback	4	trace
			Chinook salmon	1	0.06
			Flatfish	1	0.04
4	4	Henry Bay	Pacific herring Age-0+	2	0.02
			Pacific herring Age-1+	479	8.86
4	5	Henry Bay	Pacific herring Age-0+	13	0.15
			Pacific herring Age-1+	137	2.38
			Pacific herring Age-2+	1	0.03
			Midshipman	2	0.01
			Shiner perch	2	0.02
			Squid	1	trace
5	1	French Creek	Pacific herring Age-1+	57	1.64
			Pacific herring Age-2+	11294	512.58
			Chum salmon	55	7.03
5	2	French Creek	Pacific herring Age-1+	1	0.02
			Pacific herring Age-2+	230	10.72
			Chum salmon	7	1.01
			Northern Anchovy	1	trace
			Juvenile Rockfish	1	trace

Table 3 continued...

Transect	Station	Location Name	Species	Number	Weight (kg)*
5	3	French Creek	Pacific herring Age-1+	5	0.10
			Pacific herring Age-2+	338	14.61
			Northern Anchovy	10	0.05
			Chum salmon	7	0.92
			Chinook salmon	1	0.14
			Sockeye salmon	1	0.09
			Sculpin	1	trace
5	4	French Creek	Pacific herring Age-1+	9	0.19
			Pacific herring Age-2+	540	24.71
			Northern Anchovy	12	0.07
			Shiner perch	3	trace
			Chum salmon	2	0.27
			Chinook salmon	1	0.14
			Midshipman		0.07
5	5	French Creek	Pacific herring Age-2+	19	0.83
			Chum salmon	8	1.04
			Chinook salmon	1	0.09
6	1	Trincomali	Pacific herring Age-1+	428	7.38
			Pacific herring Age-2+	2	0.05
6	2	Trincomali	Pacific herring Age-0+	1	0.01
			Pacific herring Age-1+	2	0.03
			Chum salmon	4	0.45
			Northern Anchovy	1	trace
6	3	Trincomali	NO CATCH		
6	4	Trincomali	Pacific herring Age-0+	1	0.01
			Pipefish	1	0.01
6	5	Trincomali	Squid		2.25
8	1	Smelt Bay	Sculpin	5	0.06
			Squid		1.90
8	2	Smelt Bay	Pacific herring Age-0+	6	0.09
			Pacific herring Age-1+	366	5.90
			Midshipman	16	0.24
			Juvenile Pollock	2	0.01
			Squid		2.20

Table 3 continued...

Transect	Station	Location Name	Species	Number	Weight (kg)*
8	3	Smelt Bay	Pacific herring Age-0+	2	0.03
			Pacific herring Age-1+	41	0.64
			Chinook salmon	1	0.10
9	1	Atrevida Reef	Pacific herring Age-1+	366	7.18
			Pacific herring Age-2+	2966	127.92
			Northern Anchovy	33	0.79
9	2	Atrevida Reef	Pacific herring Age-1+	26	0.46
			Pacific herring Age-2+	420	18.97
			Three-spine stickleback	2	trace
			Juvenile smelt	1	trace
9	3	Atrevida Reef	Pacific herring Age-1+	41	0.78
			Pacific herring Age-2+	291	13.43
			Northern Anchovy	3	0.01
			Chum salmon	3	0.37
9	4	Atrevida Reef	Pacific herring Age-1+	33	0.59
			Pacific herring Age-2+	231	10.24
			Northern Anchovy	1	trace
			Chinook salmon	1	0.07
			Three-spine stickleback	1	trace
9	5	Atrevida Reef	Pacific herring Age-1+	15	0.30
			Pacific herring Age-2+	312	13.44
			Juvenile Pollock	3	0.03
			Chum salmon	2	0.24
10	1	Cape Cockburn	Pacific herring Age-0+	1	0.01
			Pacific herring Age-1+	4	0.08
			Pacific herring Age-2+	11	0.52
			Northern Anchovy	9	0.10
			Juvenile smelt	4	0.01
			Squid		0.08
10	3	Cape Cockburn	Juvenile Pollock	4	0.03
10	5	Cape Cockburn	NO CATCH		
11	1	Secret Cove	Pacific herring Age-1+	476	13.19
			Pacific herring Age-2+	5117	197.33
			Juvenile smelt	28	0.10
			Three-spine stickleback	28	0.03
			Squid		1.35

Table 3 continued...

Transect	Station	Location Name	Species	Number	Weight (kg)*
11	2	Secret Cove	Pacific herring Age-1+	32	0.84
			Pacific herring Age-2+	157	6.06
11	3	Secret Cove	Pacific herring Age-1+	4	0.11
			Pacific herring Age-2+	10	0.47
			Chum salmon	5	0.75
			Three-spine stickleback	1	trace
11	4	Secret Cove	Pacific herring Age-0+	2	0.02
			Pacific herring Age-1+	1	0.03
			Pacific herring Age-2+	3	0.10
			Chum salmon	11	1.55
			Chinook salmon	1	0.12
			Sockeye salmon	1	0.07
			Three-spine stickleback	1	trace
11	5	Secret Cove	Chum salmon	20	2.67
			Chinook salmon	5	0.44
			Coho salmon	1	0.05
			Juvenile Pollock	1	0.01

Table 4. Species number and weight by transect and station for 2006.

Transect	Station	Location Name	Species	Number	Weight (kg)*
1	1	Clarke Rock	NO CATCH		
1	2	Clarke Rock	Pacific herring Age-0+	5590	30.53
			Pink salmon	5	0.27
1	3	Clarke Rock	Pacific herring Age-0+	3939	18.75
1	4	Clarke Rock	Pacific herring Age-0+	9528	45.36
			Juvenile Pollock	18	0.04
1	5	Clarke Rock	Pacific herring Age-0+	7695	36.05
2	1	Yellow Point	Pacific herring Age-0+	959	3.54
			Three-spine stickleback	50	0.04
			Midshipman	17	0.02
			Gunnel	4	0.05
			Shiner perch	3	0.01
			Sandlance	2	trace
			Northern Anchovy	1	0.01
2	2	Yellow Point	Pacific herring Age-0+	3668	13.77
			Midshipman	4	0.03
			Coho salmon	2	0.04
			Gunnel	2	0.03
			Juvenile Pollock	2	0.01
2	3	Yellow Point	Pacific herring Age-0+	1012	3.93
			Three-spine stickleback	5	0.01
			Midshipman	4	0.23
			Chinook salmon	2	0.20
			Sandlance	2	trace
			Juvenile Pollock	1	trace
2	4	Yellow Point	Pacific herring Age-0+	3860	14.37
			Three-spine stickleback	15	0.01
			Midshipman	5	0.06
2	5	Yellow Point	Pacific herring Age-0+	4655	16.63
			Midshipman	15	0.81
			Shiner perch	5	0.02
			Three-spine stickleback	5	trace

* Weights \leq 9g referred to as trace.

Table 4 continued...

Transect	Station	Location Name	Species	Number	Weight (kg)*
3	1	Bowser	Pacific herring Age-0+	3	0.02
			Midshipman	11	0.01
			Sculpin	4	0.25
			Chinook salmon	1	0.11
			Northern Anchovy	1	0.02
			Shiner perch	1	0.02
			Coho salmon	1	trace
			Flatfish	1	trace
3	2	Bowser	Pacific herring Age-0+	142	1.02
			Chinook salmon	1	0.15
			Chum salmon	1	0.06
			Pipefish	1	trace
			Midshipman	1	trace
			Three-spine stickleback	1	trace
3	3	Bowser	Pacific herring Age-0+	3220	22.37
			Chinook salmon	5	0.30
			Midshipman	5	0.05
3	4	Bowser	Pacific herring Age-0+	3140	21.56
			Chinook salmon	4	0.58
3	5	Bowser	Pacific herring Age-0+	251	1.71
4	1	Henry Bay	Pacific herring Age-0+	1446	10.25
			Midshipman	9	0.01
			Juvenile Pollock	3	0.03
			Shiner perch	3	0.02
4	2	Henry Bay	Pacific herring Age-0+	1356	10.53
			Northern Anchovy	3	0.01
			Sandlance	3	0.01
			Midshipman	3	trace
4	3	Henry Bay	Pacific herring Age-0+	5340	38.55
			Midshipman	15	0.02
			Northern Anchovy	10	0.04
			Gunnel	5	0.03
4	4	Henry Bay	Pacific herring Age-0+	3296	26.03
			Gunnel	4	0.03
			Midshipman	4	trace

Table 4 continued...

Transect	Station	Location Name	Species	Number	Weight (kg)*
4	5	Henry Bay	Pacific herring Age-0+	12	0.10
			Midshipman	9	0.01
			Chinook salmon	2	0.07
			Gunnel	3	0.02
			Sandlance	1	trace
5	1	French Creek	Pacific herring Age-0+	32	0.23
			Midshipman	63	0.06
			Chum salmon	8	0.71
			Flatfish	7	0.11
			Shiner perch	7	0.05
			Chinook salmon	4	0.29
			Sculpin	4	0.03
			Sandlance	1	trace
			Pipefish	1	trace
			Three-spine stickleback	1	trace
5	2	French Creek	Pacific herring Age-0+	44	0.29
			Pacific herring Age-2+	386	25.26
			Midshipman	7	trace
			Sockeye salmon	2	0.22
			Pink salmon	2	0.08
			Pipefish	1	trace
			Three-spine stickleback	1	trace
5	3	French Creek	Pacific herring Age-0+	22	0.14
			Midshipman	9	0.01
5	4	French Creek	Pacific herring Age-0+	1	trace
5	5	French Creek	Pacific herring Age-0+	3	0.02
			Chum salmon	4	0.38
			Three-spine stickleback	2	trace
6	1	Trincomali	Pacific herring Age-0+	409	1.50
			Midshipman	5	0.01
			Juvenile Rockfish	1	trace
6	2	Trincomali	Pacific herring Age-0+	276	1.12
			Pacific herring Age-1+	1	0.02
			Juvenile Pollock	17	0.13
			Sandlance	2	trace
			Gunnel	1	0.01
			Midshipman	1	trace

Table 4 continued...

Transect	Station	Location Name	Species	Number	Weight (kg)*
6	3	Trincomali	Pacific herring Age-0+	448	1.88
			Juvenile Pollock	19	0.13
			Three-spine stickleback	2	trace
			Sandlance	1	trace
6	4	Trincomali	Pacific herring Age-0+	540	1.97
			Juvenile Pollock	2	0.01
			Sandlance	1	trace
6	5	Trincomali	Pacific herring Age-0+	23915	81.09
			Sandlance	20	0.03
8	1	Smelt Bay	Squid	18	0.62
			Chum salmon	6	0.32
			Chinook salmon	3	0.13
			Northern Anchovy	3	0.05
			Sandlance	1	trace
8	2	Smelt Bay	Pacific herring Age-0+	50	0.33
			Midshipman	8	0.20
			Juvenile Pacific Hake	3	0.01
			Chum salmon	2	0.18
8	3	Smelt Bay	Pacific herring Age-0+	13	0.07
			Sculpin	1	0.02
9	1	Atrevida Reef	Pacific herring Age-0+	10	0.04
			Three-spine stickleback	51	0.03
			Chum salmon	3	0.21
			Chinook salmon	3	0.21
			Sandlance	3	0.01
			Coho salmon	1	0.02
			Squid		0.61
9	2	Atrevida Reef	Pacific herring Age-0+	1670	7.84
			Coho salmon	8	0.49
			Whitebait smelt	6	0.01
			Juvenile Hake	4	0.04
			Juvenile Pollock	2	0.02
			Three-spine stickleback	2	trace

Table 4 continued...

Transect	Station	Location Name	Species	Number	Weight (kg)*
9	3	Atrevida Reef	Pacific herring Age-0+	5215	30.61
			Pacific herring Age-2+	5	0.22
			Juvenile Pollock	320	2.84
			Chum salmon	15	1.06
			Juvenile Pacific Hake	30	0.21
9	4	Atrevida Reef	Pacific herring Age-0+	6573	35.15
9	5	Atrevida Reef	Pacific herring Age-0+	8451	45.19
10	1	Cape Cockburn	Pacific herring Age-0+	6135	34.91
			Juvenile Pacific Hake	90	0.35
			Juvenile Pollock	70	0.55
10	2	Cape Cockburn	Pacific herring Age-0+	1346	7.23
			Juvenile Pollock	289	1.47
10	3	Cape Cockburn	Pacific herring Age-0+	252	1.31
			Juvenile Pacific Hake	2766	17.84
10	4	Cape Cockburn	Pacific herring Age-0+	966	5.19
			Juvenile Pacific Hake	310	2.38
10	5	Cape Cockburn	Pacific herring Age-0+	1084	6.25
			Northern Anchovy	1	0.02
			Juvenile Pacific Hake	1	0.01
			Juvenile Pollock	1	0.01
			Midshipman	1	trace
11	1	Secret Cove	Pacific herring Age-0+	7335	32.92
			Pacific herring Age-1+	10	0.22
			Chinook salmon	10	0.24
11	2	Secret Cove	Pacific herring Age-0+	5295	25.88
			Pacific herring Age-1+	20	0.45
			Pacific herring Age-2+	40	1.66
			Juvenile Pacific Hake	1345	11.26
			Juvenile Pollock	25	0.33
			Three-spine stickleback	12	0.02
11	3	Secret Cove	Pacific herring Age-0+	5550	27.91
			Pacific herring Age-2+	10	0.38
			Juvenile Pacific Hake	755	6.23
			Juvenile Pollock	200	2.53

Table 4 continued...

Transect	Station	Location Name	Species	Number	Weight (kg)*
11	4	Secret Cove	Pacific herring Age-0+	13794	75.44
			Juvenile Pacific Hake	165	1.17
			Juvenile Pollock	33	0.32
11	5	Secret Cove	Pacific herring Age-0+	2450	12.41
			Juvenile Pacific Hake	6377	46.62

Table 5. Species percent occurrence by year in purse seine sets.

Common Name*	Species Caught	% Occurrence	
		2005	2006
Pacific herring Age-0+	<i>Clupea pallasi</i> in year of birth	26.1	95.8
Pacific herring Age-1+	<i>Clupea pallasi</i> in first year	78.3	6.3
Pacific herring Age-2+	<i>Clupea pallasi</i> in second or more years	65.2	8.3
No herring caught	<i>Clupea pallasi</i>	13.0	4.2
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	26.1	20.8
Chum salmon	<i>Oncorhynchus keta</i>	32.6	14.6
Coho salmon	<i>Oncorhynchus kisutch</i>	2.2	8.3
Flatfish	<i>Parophyrus vetulus</i> , <i>Lepidopsetta bilineata</i> , <i>Platichthys stellatus</i> or <i>Citharichthys stigmaens</i>	6.5	4.2
Gunnel	<i>Apodichthys flavidus</i> or <i>Pholis laeta</i>	10.9	12.5
Jellyfish	<i>Cnidaria</i>	8.7	0.0
Juvenile Pacific Hake	<i>Merluccius productus</i>	0.0	22.9
Juvenile Walleye Pollock	<i>Theragra chalcogramma</i>	19.6	31.3
Juvenile Rockfish	<i>Sebastes</i> sp.	2.2	2.1
Juvenile smelt	<i>Mallotus villosus</i> , <i>Hypomesus pretiosus</i> or <i>Allosmerus elongatus</i>	6.5	0.0
Midshipman	<i>Porichthys notatus</i>	26.1	41.7
No Catch		4.3	2.1
Northern Anchovy	<i>Engraulis mordax mordax</i>	39.1	12.5
Pink salmon	<i>Oncorhynchus gorbuscha</i>	0.0	4.2
Pipefish	<i>Syngnathus griseolineatus</i>	6.5	6.3
Poacher	<i>Agonus acipenserinus</i>	2.2	0.0
Sandlance	<i>Ammodytes hexapterus</i>	2.2	22.9
Sculpin	<i>Leptocottus armatus</i>	4.3	6.3
Shiner perch	<i>Cymatogaster aggregata</i>	6.5	10.4
Sockeye salmon	<i>Oncorhynchus nerka</i>	4.3	2.1
Squid	<i>Loligo opalescens</i> or <i>Gonatus fabricii</i>	41.3	4.2
Three-spine stickleback	<i>Gasterosteus aculeatus</i>	17.4	25.0
Whitebait smelt	<i>Allosmerus elongatus</i>	0.0	2.1

* Squid and jellyfish occurrence may not be representative due to the large quantities usually encountered and the inability to correctly quantify.

Table 6. Number sampled, size range, mean length, mean weight, weight range and standard deviations for all three observed age classes. Total catch in numbers and weight of all herring by transect for 2005.

Age-0+			Length (mm)			Weight (g)				Catch	Total Catch Weight (Kg)
Location Name	Transect	Sampled	Range	Mean	STDev	Range	Mean	STDev			
Clarke Rock	1	0	-	-	-	-	-	-	-	-	-
Yellow Point	2	4	80-100	91	10.75	6.7-14.8	10.30	4.08	4		0.04
Bowser	3	1	99	99	0.00	13.8	13.80	0.00	1		0.01
Henry Bay	4	15	91-100	97	3.46	9-15.3	11.74	1.69	18		0.22
French Creek	5	0	-	-	-	-	-	-	-	-	-
Trincomali	6	2	95-99	97	2.83	11.5-12.6	12.05	0.78	2		0.02
Smelt Bay	8	5	97-100	99	1.22	13.5-15.2	14.36	0.74	8		0.11
Atrevida Reef	9	0	-	-	-	-	-	-	-	-	-
Cape Cockburn	10	1	100	100	0.00	13.5	13.50	0.00	1		0.01
Secret Cove	11	2	82-99	91	12.02	7.7-13.3	10.50	3.96	2		0.02
All Locations		30		96	5.41		12.05	2.17	36		0.45

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Age-1+			Length (mm)			Weight (g)				Catch	Total Catch Weight (Kg)
Location Name	Transect	Sampled	Range	Mean	STDev	Range	Mean	STDev			
Clarke Rock	1	135	103-126	118	5.31	14.4-32.1	21.92	4.03	172		3.92
Yellow Point	2	84	101-119	108	3.72	12.9-20.2	15.88	1.56	84		1.33
Bowser	3	115	107-126	117	4.33	16.7-29.4	20.87	2.53	111		2.31
Henry Bay	4	388	101-125	111	4.93	12-27.8	18.06	2.34	712		13.00
French Creek	5	8	110-126	117	5.97	17.8-28.7	21.84	4.23	72		1.95
Trincomali	6	201	101-122	110	3.89	11.4-23.4	17.23	2.01	430		7.41
Smelt Bay	8	238	101-125	108	4.16	7.2-25.1	16.04	2.05	407		6.54
Atrevida Reef	9	93	103-125	114	4.77	12.7-26.1	18.76	2.49	481		9.31
Cape Cockburn	10	4	112-121	117	3.92	17.9-22.2	20.53	1.85	4		0.08
Secret Cove	11	54	111-126	123	2.83	18.8-35.9	26.75	2.90	513		14.16
All Locations		1320		112	4.49		18.51	2.50	2986		60.03

Table 6 continued...

Age-2+	Length (mm)						Weight (g)				Catch	Total Catch	Weight (Kg)
	Location Name	Transect	Sampled	Range	Mean	STDev	Range	Mean	STDev				
Clarke Rock	1	463	127-186	138	6.71		23.6-98.7	40.71	8.17	1014			40.73
Yellow Point	2	1	132	132	0.00		31.7	31.70	0.00	1			0.03
Bowser	3	165	127-160	138	6.76		25.3-53.8	36.37	6.26	157			5.71
Henry Bay	4	3	129-136	133	3.61		26.6-33.8	31.03	3.88	3			0.09
French Creek	5	794	127-207	146	7.98		28.1-132.5	45.20	8.89	12421			563.44
Trincomali	6	1	128	128	0.00		26.2	26.20	0.00	2			0.05
Smelt Bay	8	0	-	-	-		-	-	-	-			-
Atrevida Reef	9	907	127-187	147	8.09		24.5-93.1	44.33	8.50	4220			184.00
Cape Cockburn	10	11	133-157	147	6.08		34.1-61.8	47.57	8.26	11			0.52
Secret Cove	11	353	127-183	139	8.03		20.8-91.6	38.78	8.53	5287			203.96
All Locations		2698		144	7.74			42.74	8.91	23116			998.55

Table 7. Number sampled, size range, mean length, weight range, mean weight, and standard deviations for all three observed age classes. Total catch in numbers and weight of all herring by transect for 2006.

Age-0+			Length (mm)			Weight (g)					
Location Name	Transect	Sampled	Range	Mean	STDev	Range	Mean	STDev	Catch	Total Catch Weight (Kg)	
Clarke Rock	1	800	64-81	74	4.09	3.21-8.99	4.82	0.82	26752	130.68	
Yellow Point	2	1000	57-79	67	3.12	2.05-5.4	3.67	0.45	14154	52.23	
Bowser	3	745	72-97	83	3.71	4.69-11.76	6.94	0.90	6756	46.68	
Henry Bay	4	812	67-108	86	4.75	3.26-14.85	7.65	1.13	11450	85.47	
French Creek	5	102	73-98	84	5.34	4.53-11.9	6.71	1.54	102	0.68	
Trincomali	6	999	56-98	68	5.52	2.02-12.6	3.86	1.04	25588	87.56	
Smelt Bay	8	63	70-91	79	5.50	4.26-9.56	6.33	1.28	63	0.40	
Atrevida Reef	9	410	60-104	76	5.76	2.64-14.69	5.26	1.37	21919	118.84	
Cape Cockburn	10	776	66-98	77	4.75	2.82-11.72	5.42	1.04	9783	54.88	
Secret Cove	11	988	63-99	76	4.12	3.04-11.98	5.02	0.84	34424	174.57	
All Locations		6695		75	4.49		5.25	0.95	150991	751.99	

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Age-1+			Length (mm)			Weight (g)					
Location Name	Transect	Sampled	Range	Mean	STDev	Range	Mean	STDev	Catch	Total Catch Weight (Kg)	
Clarke Rock	1	-	-	-	-	-	-	-	-	-	
Yellow Point	2	-	-	-	-	-	-	-	-	-	
Bowser	3	-	-	-	-	-	-	-	-	-	
Henry Bay	4	-	-	-	-	-	-	-	-	-	
French Creek	5	-	-	-	-	-	-	-	-	-	
Trincomali	6	1	122	122	0.00	22.82	22.82	0.00	1	0.02	
Smelt Bay	8	-	-	-	-	-	-	-	-	-	
Atrevida Reef	9	-	-	-	-	-	-	-	-	-	
Cape Cockburn	10	-	-	-	-	-	-	-	-	-	
Secret Cove	11	6	113-128	119	5.14	19.79-26.98	22.22	2.65	30	0.67	
All Locations		7		119	5.14		22.30	2.65	31	0.69	

Table 7 continued...

Age-2+	Length (mm)					Weight (g)					Total Catch Weight (Kg)
	Location Name	Transect	Sampled	Range	Mean	STDev	Range	Mean	STDev	Catch	
Clarke Rock	1	-	-	-	-	-	-	-	-	-	-
Yellow Point	2	-	-	-	-	-	-	-	-	-	-
Bowser	3	-	-	-	-	-	-	-	-	-	-
Henry Bay	4	-	-	-	-	-	-	-	-	-	-
French Creek	5	200	139-207	165	12.61	37.35-135.32	65.43	17.59	386		25.26
Trincomali	6	-	-	-	-	-	-	-	-	-	-
Smelt Bay	8	-	-	-	-	-	-	-	-	-	-
Atrevida Reef	9	1	156	156	0.00	43.14	43.14	0.00	5		0.22
Cape Cockburn	10	-	-	-	-	-	-	-	-	-	-
Secret Cove	11	11	139-150	144	3.64	30.36-42.27	37.02	3.56	50		2.04
All Locations		212		164	12.33		63.85	17.09	441		27.51

Table 8. Categories of organisms, by phylum, found in 2005 and 2006 plankton tows.

<u>Coelenterata</u>	
COEL	Medusae
SIPH	Siphonophores
<u>Ctenophora</u>	
CTEN	Ctenophores
<u>Annelida</u>	
POLY	Polychaetes – segmented worms
<u>Mollusca</u>	
GAST	Prosobranch gastropods
PELE	Pelecypods
<u>Arthropoda</u>	
AMPH	Amphipods
BARN	Barnacle, unknown stage
CLAD	Cladocerans; <i>Podon</i> sp. and <i>Evadne</i> sp.
COPE	Copepods (See Table 6 for a list of species)
CRAM	Crab megalopea, including porcellinadea
CRAZ	Crab zoea, including porcellinadea
EUPA	Euphausiid adults
EUPL	Euphausiid larvae (nauplii, protozoa and zoea)
MYSI	Mysids
SHRI	Shrimp (natant decapod) zoea
<u>Ectoprocta</u>	
ECTO	Ectoprocts, mostly <i>Membranipora</i> sp. larvae (cyphonautes)
<u>Echinodermata</u>	
ECHI	Echinoderm larvae
<u>Chaetognatha</u>	
CHAE	Chaetognaths, mostly <i>Sagitta</i> sp.
<u>Chordata</u>	
LARV	Larvaceans, mostly <i>Oikopleura</i> sp., and tunicate larvae
OTHJ	Teleost larvae
<u>Miscellaneous</u>	
EGGS	Unidentified eggs, euphausiid or teleost

Table 9. Calanoid and cyclopoid copepods identified in 2005 and 2006 plankton samples. Abbreviations are used to identify organisms in Tables 10 and 11.

Calanoid copepods

ADIV	<i>Aetidius divergens</i>
ALON	<i>Acartia longiremis</i>
CABD	<i>Centropages abdominales</i>
CMAR	<i>Calanus marshallae</i>
CNAU	Unidentified copepod nauplii
CPAC	<i>Calanus pacificus</i>
EBUN	<i>Eucalanus bungii</i>
ELON	<i>Epilabidocera longipedata</i>
MPSE	<i>Metridia pseudopacifica</i>
OBOR	<i>Oncaea borealis</i>
PMIN	<i>Pseudocalanus minutus</i>
PPAR	<i>Paracalanus parvus</i>
SMIN	<i>Scolecithricella minor</i>
TDIS	<i>Tortanus discaudatus</i>
UCAL	Unidentified calanoids, unknown species

Cyclopoid copepods

CANG	<i>Corcaeeus anglicus</i>
OATL	<i>Oithona atlantica</i>
OITH	<i>Oithona sp.</i>
OSIM	<i>Oithona similis</i>

Table 10. Zooplankton density per set in number of organisms per m³ of water sampled for 2005. Species codes located in Tables 8 and 9.

Location	Tran	Stn	Volume (m ³)	ADIV	ALON	AMPH	BARN	CABD	CANG	CHAE	CLAD	CMAR	CNAU	COEL
Clarke Rock	1	3	13.4209	-	-	81.8	4.8	-	81.0	0.5	-	-	-	-
Yellow Point	2	1	12.2023	-	-	0.2	18.4	-	309.4	-	-	-	2.6	0.4
Yellow Point	2	3	11.3452	-	-	-	67.7	-	490.8	-	-	-	-	0.7
Bowser	3	1	4.5676	-	-	-	924.8	-	56.0	-	560.5	-	28.0	-
Henry Bay	4	3	4.3371	-	-	-	427.9	-	169.7	-	118.0	-	29.5	-
Henry Bay	4	5	5.3547	-	-	-	406.6	-	71.7	-	71.7	0.2	47.8	0.2
French Creek	5	1	13.7955	-	-	0.1	64.9	4.6	51.0	-	4.6	-	46.4	0.1
French Creek	5	3	18.0635	-	14.2	99.3	-	14.2	198.4	-	-	-	28.3	0.1
Trincomali Channel	6	1	8.7283	-	-	24.1	375.8	-	44.0	-	-	0.1	-	-
Trincomali Channel	6	3	11.5916	-	-	25.0	510.7	-	69.0	0.2	-	-	-	0.1
Atrevida Reef	9	1	13.9925	-	-	2.4	2.3	2.3	27.4	-	-	-	2.3	0.1
Atrevida Reef	9	3	18.1327	-	-	85.1	-	-	28.2	0.4	-	-	-	-
Cape Cockburn	10	1	15.5500	-	2.1	13.6	4.4	-	5.1	0.1	-	-	-	-
Cape Cockburn	10	3	16.1584	-	-	35.6	-	-	11.9	2.5	-	-	-	0.2
Secret Cove	11	1	15.1949	-	3.2	1.2	1.3	-	11.6	0.1	-	-	3.2	0.1
Secret Cove	11	2	18.5692	6.9	-	28.2	3.4	-	24.1	0.4	-	-	-	-

Table 10 continued...

Location	Tran	Stn	CPAC	CRAM	CRAZ	CTEN	ECHI	ECTO	EGGS	ELON	EUPA	EUPL	GAST	LARV	MPSE
Clarke Rock	1	3	-	-	0.1	-	-	-	-	-	-	-	9.5	4.8	-
Yellow Point	2	1	-	-	11.1	0.8	-	5.2	128.5	-	-	34.1	7.9	49.8	-
Yellow Point	2	3	27.5	0.4	-	-	5.6	-	197.4	-	-	67.9	16.9	84.6	-
Bowser	3	1	-	0.7	15.5	0.4	-	-	-	-	-	-	98.1	1443.2	-
Henry Bay	4	3	0.2	-	7.6	-	-	7.4	8.1	-	-	-	36.9	1542.0	-
Henry Bay	4	5	-	-	0.2	-	-	-	-	-	0.4	-	23.9	4254.9	-
French Creek	5	1	0.1	-	-	-	-	-	-	-	-	-	23.2	74.2	-
French Creek	5	3	4.9	-	0.1	-	-	-	-	-	-	-	14.2	14.2	-
Trincomali Channel	6	1	-	-	0.1	-	-	-	1.8	-	-	0.1	25.7	286.0	-
Trincomali Channel	6	3	0.9	-	-	-	-	-	2.8	0.3	-	11.0	8.3	284.3	0.2
Atrevida Reef	9	1	-	-	0.1	0.4	-	-	-	-	-	-	29.7	107.5	-
Atrevida Reef	9	3	15.0	-	-	-	-	-	-	0.4	-	30.0	14.1	-	-
Cape Cockburn	10	1	0.8	-	-	0.1	-	-	-	-	-	-	-	-	-
Cape Cockburn	10	3	9.4	-	-	-	-	-	-	-	-	37.4	4.0	-	-
Secret Cove	11	1	0.1	-	-	0.2	-	-	-	-	0.2	-	1.1	76.9	-
Secret Cove	11	2	10.1	-	-	-	-	-	-	-	40.3	0.6	-	13.8	13.4

Table 10 continued...

Location	Tran	Stn	MYSI	OITH	OSIM	PELE	PMIN	POLY	PPAR	SHRI	SIPH	TDIS	UCAL
Clarke Rock	1	3	-	204.9	214.5	4.8	309.8	4.9	185.9	0.2	0.2	-	121.1
Yellow Point	2	1	-	-	5.2	-	-	2.8	44.6	6.5	92.3	-	49.8
Yellow Point	2	3	-	-	16.9	-	-	6.0	95.9	10.2	99.8	-	376.5
Bowser	3	1	-	14.0	14.0	-	98.1	14.0	518.4	4.4	-	-	99.4
Henry Bay	4	3	-	14.8	29.5	-	51.6	44.3	132.8	18.4	0.5	-	236.3
Henry Bay	4	5	-	12.0	47.8	-	23.9	47.8	47.8	-	12.0	-	107.9
French Creek	5	1	-	116.0	264.4	-	32.5	32.5	552.1	-	-	-	190.2
French Creek	5	3	-	467.7	201.1	-	467.7	-	581.1	0.4	0.1	-	1151.3
Trincomali Channel	6	1	-	-	9.2	9.2	60.5	1.8	165.0	0.3	1.8	0.1	45.5
Trincomali Channel	6	3	-	-	-	8.3	24.8	-	60.7	11.3	-	2.8	52.8
Atrevida Reef	9	1	-	32.0	34.3	2.3	473.4	-	91.5	-	0.2	-	263.1
Atrevida Reef	9	3	-	14.1	56.5	-	1736.5	-	338.8	0.2	0.2	-	1525.0
Cape Cockburn	10	1	-	5.1	8.2	-	136.8	-	25.7	-	0.1	-	47.5
Cape Cockburn	10	3	-	-	15.8	-	336.7	2.2	55.5	0.2	4.0	-	896.1
Secret Cove	11	1	0.1	4.2	15.8	-	47.4	1.1	84.2	1.3	-	-	44.8
Secret Cove	11	2	-	-	-	-	251.6	0.2	137.9	0.2	-	-	110.7

Table 11. Zooplankton density per set in number of organisms per m³ of water sampled for 2006. Species codes located in Tables 8 and 9.

Location	Tran	Stn	Volume (m ³)	ALON	AMPH	BARN	CABD	CANG	CHAE	CLAD	CNAU	COEL	CPAC	CRAM	CRAZ
Clarke Rock	1	1	16.4986	-	1.5	5.6	-	3.2	-	16.7	-	1.6	-	0.1	0.7
Clarke Rock	1	3	8.8961	-	0.9	0.7	-	4.3	-	8.2	-	0.4	-	-	0.3
Yellow Point	2	1	16.8674	-	0.5	8.5	-	1.4	-	44.1	-	0.4	-	0.4	0.3
Yellow Point	2	3	10.5387	-	4.6	13.8	-	3.0	0.1	164.0	-	2.8	6.3	0.6	1.8
Bowser	3	1	5.9859	21.4	-	326.6	-	16.0	-	973.0	-	-	-	0.2	1.0
Bowser	3	4	9.7723	-	6.5	458.6	-	-	-	563.2	-	0.4	4.0	0.3	0.6
Henry Bay	4	3	5.2088	-	6.1	424.1	-	73.7	-	307.2	110.6	1.0	-	-	1.0
Henry Bay	4	5	3.2074	-	-	1247.1	-	109.7	-	668.5	10.0	2.2	-	-	0.9
French Creek	5	1	8.5563	-	-	82.9	7.5	15.0	3.7	175.8	-	0.5	-	-	0.1
French Creek	5	3	8.6264	-	4.4	5.6	-	35.2	-	13.0	-	-	-	-	-
Trincomali Channel	6	1	16.4468	-	-	90.6	-	20.4	-	151.8	-	3.3	-	0.2	1.3
Trincomali Channel	6	3	10.2880	-	1.0	121.3	0.8	32.7	-	98.8	-	1.3	-	0.1	9.5
Smelt Bay	8	1	14.7799	3.2	1.3	33.0	-	4.3	-	66.0	-	3.0	-	-	0.1
Smelt Bay	8	2	10.7550	3.0	0.4	81.8	6.0	7.4	-	41.7	-	9.0	-	0.1	16.6
Atrevida Reef	9	1	17.7229	2.3	1.9	5.9	0.5	0.5	-	9.5	-	4.9	0.1	-	1.3
Atrevida Reef	9	3	18.7857	5.5	2.8	3.8	1.7	1.7	-	20.0	-	2.7	-	-	-
Cape Cockburn	10	1	18.9975	-	0.4	0.7	0.1	1.1	-	0.6	-	0.2	-	-	0.1
Cape Cockburn	10	3	11.4262	-	1.1	3.9	-	0.7	0.7	6.3	-	-	3.2	-	-
Secret Cove	11	1	19.3510	-	0.4	14.3	-	2.5	-	30.6	0.8	0.5	-	-	-
Secret Cove	11	3	16.6998	-	4.9	1.6	-	1.0	0.1	5.7	-	0.1	3.1	-	-

Table 11 continued...

Location	Tran	Stn	CTEN	ECHI	ECTO	EGGS	EUPA	EUPL	GAST	LARV	MPSE	MYSI	OATL	OBOR
Clarke Rock	1	1	0.2	-	0.2	-	-	-	1.2	0.5	-	-	1.5	-
Clarke Rock	1	3	-	-	-	0.2	-	-	0.6	0.3	-	-	0.2	-
Yellow Point	2	1	0.7	0.5	0.9	2.4	-	-	2.4	18.0	-	-	-	-
Yellow Point	2	3	1.1	10.6	-	13.7	0.1	0.1	21.3	59.2	-	-	-	-
Bowser	3	1	-	16.0	-	-	-	-	-	2913.5	-	-	-	-
Bowser	3	4	-	-	-	-	0.1	0.7	26.2	956.2	0.7	-	-	-
Henry Bay	4	3	-	-	18.4	-	-	-	18.4	1327.0	-	-	-	30.7
Henry Bay	4	5	-	10.0	10.0	-	-	-	189.6	828.1	-	-	-	-
French Creek	5	1	-	-	-	-	-	-	18.7	796.6	-	0.1	-	7.5
French Creek	5	3	-	-	-	-	-	-	9.3	187.3	-	-	-	-
Trincomali Channel	6	1	0.1	26.3	-	1.0	-	-	-	49.6	-	-	-	-
Trincomali Channel	6	3	0.3	1.6	-	-	-	-	1.5	38.9	-	-	-	-
Smelt Bay	8	1	0.1	-	8.7	-	-	1.2	14.1	84.4	-	-	-	-
Smelt Bay	8	2	9.1	10.4	-	-	-	-	68.4	41.7	-	-	-	-
Atrevida Reef	9	1	-	2.3	2.7	-	0.3	-	10.4	23.0	-	-	-	-
Atrevida Reef	9	3	0.1	-	-	-	0.4	0.2	7.7	8.9	0.5	-	-	-
Cape Cockburn	10	1	0.1	-	-	-	-	-	0.2	-	0.1	-	0.1	-
Cape Cockburn	10	3	-	-	-	-	23.8	-	-	-	-	-	2.1	-
Secret Cove	11	1	-	-	2.1	-	-	-	0.4	9.5	-	-	0.4	-
Secret Cove	11	3	-	-	-	-	1.9	0.1	3.4	1.0	24.2	-	-	-

Table 11 continued...

Location	Tran	Stn	OITH	OSIM	OTHJ	PELE	PMIN	POLY	PPAR	SHRI	SIPH	SMIN	TDIS	UCAL
Clarke Rock	1	1	-	-	0.1	-	-	0.2	0.2	3.2	34.9	-	-	1.5
Clarke Rock	1	3	-	0.8	-	-	0.3	-	0.1	1.3	16.7	-	0.2	2.4
Yellow Point	2	1	-	0.9	-	-	-	0.9	-	2.4	51.0	-	-	12.3
Yellow Point	2	3	-	4.6	0.1	-	-	-	-	10.3	154.0	-	-	116.3
Bowser	3	1	-	-	-	-	-	-	80.2	0.5	-	-	0.2	-
Bowser	3	4	13.1	45.8	-	-	-	0.1	45.8	0.8	33.8	-	-	20.1
Henry Bay	4	3	92.2	141.3	-	-	-	-	110.6	-	76.0	-	-	313.3
Henry Bay	4	5	349.2	259.4	-	-	-	279.4	389.1	10.6	62.0	-	-	798.2
French Creek	5	1	7.5	108.5	-	-	-	3.7	172.0	4.2	42.3	-	-	33.7
French Creek	5	3	5.6	42.7	-	-	-	-	77.9	1.9	27.9	-	-	22.3
Trincomali Channel	6	1	-	-	-	-	-	0.1	1.0	8.8	33.4	-	-	8.8
Trincomali Channel	6	3	-	-	0.1	-	-	0.9	-	10.0	4.2	-	-	0.8
Smelt Bay	8	1	4.3	6.5	-	3.2	-	4.3	9.7	9.2	28.3	-	-	20.6
Smelt Bay	8	2	-	-	-	-	-	7.4	13.4	3.4	175.3	-	-	40.2
Atrevida Reef	9	1	17.6	36.1	0.1	-	0.5	2.3	1.8	6.0	15.0	-	-	14.9
Atrevida Reef	9	3	6.4	15.3	-	-	3.4	1.1	3.0	0.6	4.0	-	1.3	29.8
Cape Cockburn	10	1	2.0	0.7	-	-	0.1	0.1	0.1	0.4	2.2	-	-	0.6
Cape Cockburn	10	3	-	-	-	-	0.4	4.2	-	-	0.4	-	-	45.2
Secret Cove	11	1	1.7	8.3	-	-	-	0.8	0.4	1.4	4.8	-	-	4.2
Secret Cove	11	3	-	1.9	-	-	-	-	1.4	0.8	14.4	1.0	-	61.3



